TEST REPORT

IEC / EN 62040-1

Uninterruptible power systems (UPS) – Part 1: General and safety requirements for UPS

Report Reference No.....:	9012326349
Date of issue .....:	28.10.2010
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CB Testing Laboratory .....:	The Standards Institution of Israel
Address .....:	42 Chaim Levanon St., 69977 Tel Aviv, Israel
Applicant's name.....:	Gamatronic Electronic Industries Ltd.
Address .....:	14 Hartom Str., Har Hotsvim Science-Based Industrial Park, POB 45029, Jerusalem, 45029 Israel
Test specification:	
Standard.....:	IEC / EN 62040-1 : 2008 (1st Edition)
Test procedure .....:	N/A
Non-standard test method……..:	N/A
Test Report Form No.....:	IEC62040_1A
Test Report Form(s) Originator .....:	TÜV Rheinland Japan Ltd.
Master TRF .....:	Dated 2009-11

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Test item description .....:	Uninterruptible Power System
Trade Mark .....:	GAMATRONIC™
Manufacturer .....:	Gamatronic Electronic Industries Ltd.
Model/Type reference .....:	MEGA SYSTEM 250KW 400V 3/3, Cat. No. 101SMD60
Ratings .....:	Input: 3x400Vac, 50Hz, 3x420A (max.); Output: 3x400Vac, 50Hz, 3x360A (max.)

Testing procedure and testing location:
☐ **CB Testing Laboratory:** Testing location/ address .....: ☐ **Associated CB Laboratory:** Testing location/ address .....: Tested by (name + signature).....: SERGEY VOYTENKO Approved by (+ signature) .....: MICHAEL TERMAN
☐ Testing procedure: TMP Tested by (name + signature).....: Approved by (+ signature) .....: Testing location/ address .....:
☐ Testing procedure: WMT Tested by (name + signature).....: Witnessed by (+ signature).....: Approved by (+ signature) .....: Testing location/ address .....:
☐ Testing procedure: SMT Tested by (name + signature).....: Approved by (+ signature) .....: Supervised by (+ signature).....: Testing location/ address .....:
☐ Testing procedure: RMT Tested by (name + signature).....: Approved by (+ signature) .....: Supervised by (+ signature).....: Testing location/ address .....:

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Summary of testing:	
Tests performed (name of test and test clause): 5.1.4. Backfeed protection. 5.3 Protective earthing and bonding. 5.5. Over current and earthing fault protection. 5.7. Clearance, creepage and distance through insulation. 7.3. Mechanical strength. 7.4.2. Openings. 7.7 Temperature rise. 8.2 Electrical strength. 8.3 Abnormal operating and fault conditions.	**Testing location:** 14 Hartom Str., Har Hotsvim Science-Based Industrial Park, POB 45029, Jerusalem, 45029 Israel

Appendices:

Appendix 1 – Photographs
Appendix 2 – Electrical Schematics
Appendix 3 – European Group Differences and National Differences (EN 62040-1: 2008)

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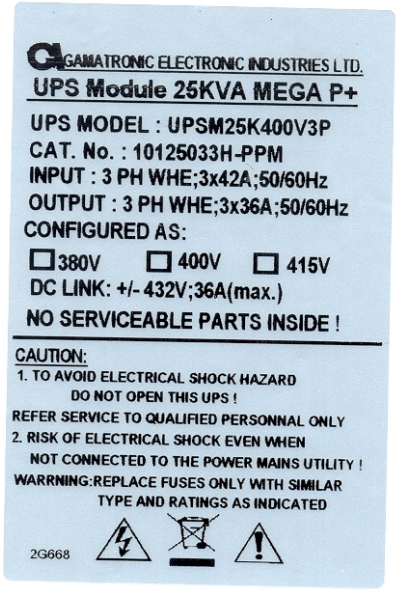
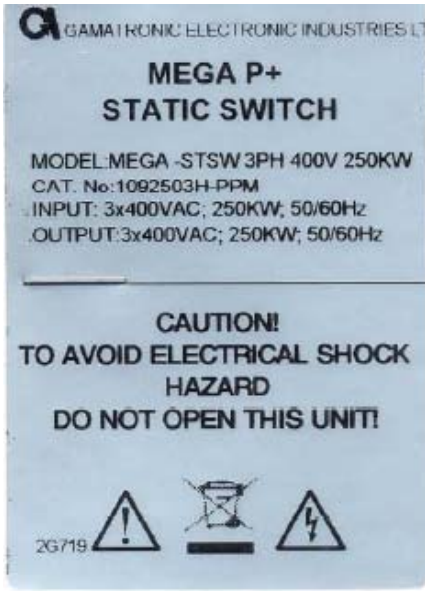
Copy of marking plate:

SYSTEM

Power Module


GAMATRONIC ELECTRONIC INDUSTRIES LTD.
UPS Module 25KVA MEGA P+
UPS MODEL : UPSM25K400V3P
CAT. No. : 10125033H-PPM
INPUT : 3 PH WHE;3x42A;50/60Hz
OUTPUT : 3 PH WHE;3x36A;50/60Hz
CONFIGURED AS:
380V 400V 415V
DC LINK: +/- 432V;36A(max.)
NO SERVICEABLE PARTS INSIDE !
CAUTION:
1. TO AVOID ELECTRICAL SHOCK HAZARD
DO NOT OPEN THIS UPS !
REFER SERVICE TO QUALIFIED PERSONNAL ONLY
2. RISK OF ELECTRICAL SHOCK EVEN WHEN
NOT CONNECTED TO THE POWER MAINS UTILITY !
WARRNING:REPLACE FUSES ONLY WITH SIMILAR
TYPE AND RATINGS AS INDICATED
2G668

Static Switch



Controller

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Test item particulars ..... :	
Equipment mobility ..... :	[] movable [x] stationary [] for building-in
Connection to the mains ..... :	[] pluggable equipment [x] permanent connection [] detachable power supply cord [] non-detachable power supply cord
Operating condition ..... :	[x] continuous [] rated operating / resting time:
Access location ..... :	[x] operator accessible [] restricted access location
Over voltage category (OVC) ..... :	[] OVC I [x] OVC II [] OVC III [] OVC IV [] other:
Mains supply tolerance (%) or absolute mains supply values ..... :	+/- 10%
Tested for IT power systems ..... :	[] Yes [x] No
IT testing, phase-phase voltage (V) ..... :	--
Class of equipment ..... :	[x] Class I [] Class II [] Not classified
Considered current rating (A) ..... :	420A
Pollution degree (PD) ..... :	[] PD 1 [x] PD 2 [] PD 3
IP protection class ..... :	IP2X
Altitude during operation (m) ..... :	2000
Altitude of test laboratory (m) ..... :	35
Mass of equipment (kg) ..... :	450 kg
Possible test case verdicts:	
- test case does not apply to the test object ..... :	N/A
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Testing ..... :	
Date of receipt of test item ..... :	11.07.2010
Date(s) of performance of tests ..... :	11.07.2010 – 30.08.2010

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

Throughout this report a comma (point) is used as the decimal separator.
Standard IEC 62040-1:2008 is to be used in conjunction with IEC 60950-1:2005, which is referred to in this TRF as "RD".

General product information:

1. The equipment is a modular uninterruptible power system (UPS). The following modules are incorporated in the equipment: 25kVA Power Module (up to 10 units), Controller Module, and Static Switch Module.
2. Battery compartment and batteries are not supplied with the UPS.
3. End-user should provide an external circuit breaker specified in the installation instructions.

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IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
4	GENERAL CONDITIONS FOR TESTS		P
4.5	Components		P
	Comply with IEC 62040-1 or relevant component standard	(see appended table 4.5)	P
1.5.2/RD	Evaluation and testing of components	Components which are certified to IEC and/or national standards are used correctly within their ratings. Components not covered by IEC standards are tested under the conditions present in the equipment.	P
1.5.3/RD	Thermal controls	Thermal switch in Power Module Card 1012 is certified and used correctly.	P
1.5.4/RD	Transformers	Transformers used in the equipment are suitable for their intended application and comply with the relevant requirements of the standard.	P
1.5.5/RD	Interconnecting cables	All interconnecting cables are located within enclosure and are treated as internal wiring.	N/A
1.5.6/RD	Capacitors bridging insulation	Provided in cards of Power Module. Lines to Ground capacitors comply with IEC 60384-14.	P
1.5.7/RD	Resistors bridging insulation	No such components	N/A
1.5.7.1/RD	Resistors bridging functional, basic or supplementary insulation		N/A
1.5.7.2/RD	Resistors bridging double or reinforced insulation between a.c. mains and other circuits		N/A
1.5.7.3/RD	Resistors bridging double or reinforced insulation between a.c. mains and antenna or coaxial cable		N/A
1.5.8/RD	Components in equipment for IT power systems	The equipment is not intended for IT power systems	N/A
4.6	Power interface		P
1.6.1/RD	AC power distribution systems		P
1.6.2/RD	Input current	(see appended table 4.6)	P
4.6 1.6.4/RD	Neutral conductor	Neutral conductor is isolated from earthed parts by basic insulation within the equipment.	P

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IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
4.7	Marking and instructions		P
4.7.1	General		P
4.7.2	Power rating		P
	Input rated voltage/range (V) .....:	400V	P
	Input rated current/range (A).....:	420A	P
	Input symbol for nature of supply (d.c.) .....:	--	N/A
	Input rated frequency/range (Hz) .....:	50/60Hz	P
1.7.1/RD	Number of Input phases and neutral.....:	3~, N	P
	Output rated voltage/range (V) .....:	400V	P
	Output rated current/range (A) .....:	360A	P
	Output rated power factor, (if less than unity, or active power and apparent power or active power and rated current) .....:	Active output power and output current are rated	P
1.7.1/RD	Number of output phases and neutral.....:	3~, N	P
	Output rated active power (W) .....:	250 kW	P
	Output rated apparent power (VA) .....:		N/A
	Output symbol for nature of supply (d.c.) .....:		N/A
	Output rated frequency/range (Hz) .....:	50Hz	P
	Ambient operating temperature range (°C).....:	-10 to +40ºC (provided in User Manual)	P
	Manufacturer's name or trademark or identification mark .....:	GAMATRONIC	P
	Type/model or type reference .....:	MEGA SYSTEM 250KW 400V 3/3, Cat. No. 101SMD60	P
	Symbol for Class II equipment only .....:	Class I equipment	N/A
	Other symbols .....:	Warning symbols "General hazard" and "Electric shock Hazard".	P
	Certification marks .....:	No certification marks	N/A
	Instructions for units with automatic bypass/maintenance bypass, additional input a.c. supply, or external batteries, having text "See installation instructions before connecting to the supply" .....:	Provided in Installation Manual.	P
4.7.3	Safety instructions		P
4.7.3.1	General		P
4.7.3.2	Installation ..... :		P
	Location in a restricted access location only ... :	--	N/A

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IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Permanent connector UPS ..... :	Suitable statement is provided in Installation Manual	P
	Pluggable type A or Pluggable type B UPS .... :	--	N/A
4.7.3.3	Operation..... :	Suitable statement is provided in User /Operational Manual	P
4.7.3.4	Maintenance..... :	According to the Service Manual, maintenance of product is done only by service personnel.	P
4.7.3.5	Distribution related backfeed..... :		P
4.7.4 1.7.4/RD	Main voltage adjustment ..... :	--	N/A
	Methods and means of adjustment; reference to installation instructions ..... :	--	N/A
4.7.5 1.7.5/RD	Power outlets..... :	No standard power outlets. The equipment is provided with output terminals.	N/A
4.7.6 1.7.6/RD	Fuse identification (marking, special fusing characteristics, cross-reference) ..... :	Fuses are not located in operator access area. Unambiguous reference to service documentation is provided.	P
4.7.7 1.7.7/RD	Wiring terminals		P
1.7.7.1/RD	Protective earthing and bonding terminals ..... :	Main protective earthing bus bar located in the Mounting Rack is provided with IEC 60417-2-IEC5019 marking. Bonding terminals in the Modules are provided with symbol IEC60417-2-IEC 5017.	P
1.7.7.2/RD	Terminals for a.c. mains supply conductors	Input and output terminals of the Static Switch (rear panel) are marked.	P
1.7.7.3/RD	Terminals for d.c. mains supply conductors	Not connected to the DC mains	N/A
4.7.8	Battery terminals ..... :	Terminals for battery connections (Static Switch rear panel) are marked with “+” and “–“	P
4.7.9 1.7.8/RD	Controls and indicators		P
1.7.8.1/RD	Identification, location and marking ..... :	All circuit breakers are marked in accordance with circuits in which they are used.	P

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IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
1.7.8.2/RD	Colours .....:	Only functional non-safety related indicators are used.	P
1.7.8.3/RD	Symbols according to IEC 60417.....:	Symbols according to IEC 60417 are used on approved circuit breakers and contactors.	P
1.7.8.4/RD	Markings using figures .....:		N/A
4.7.10 1.7.9/RD	Isolation of multiple power sources .....:	The equipment is connected to AC mains and external battery. Warning marking for service personnel is provided in the product User Manual.	P
4.7.11 1.7.2.4/RD	IT power systems		N/A
4.7.12	Protection in building installation	External circuit breakers are specified by manufacturer for all possible configurations and number of the Power Modules used.	P
4.7.13 5.1/RD	High leakage current (mA) .....:	Required label is provided:	P
4.7.14 1.7.10/RD	Thermostats and other regulating devices		N/A
4.7.15 1.7.2.1/RD and 1.7.8.1/RD	Language(s) .....:	English was reviewed	—
4.7.16 1.7.11/RD	Durability of markings		P
4.7.17 1.7.12/RD	Removable parts	The marking are not located on the removable parts	P
4.7.18 1.7.13/RD	Replaceable batteries	Such batteries are not used	N/A
	Language(s) .....:		—
4.7.19 1.7.2.5/RD	Operator access with a tool.....:	A tool is not required to gain access to the operator access area	N/A
4.7.20	Battery	Not supplied with the equipment	N/A
	Clearly legible information .....:		N/A
	Battery type ..... :		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Nominal voltage of total battery (V) ..... :		N/A
	Nominal capacity of total battery (optional) ..... :		N/A
	Warning label ..... :		N/A
	Instructions ..... :		N/A
2.1.1.5/RD	Protection against energy hazards	There are no bare live parts in the Operator access area which may be bridged by test finger.	N/A
4.7.21 1.7.2.4/RD	Installation instructions	Suitable Instructions are provided in Installation Manual. The appliance is not intended for connection to IT power systems.	P
5	FUNDAMENTAL DESIGN REQUIREMENTS		P
5.1	Protection against electric shock and energy hazards		P
5.1.1 2.1.1/RD	Protection for UPS intended to be used in operator access areas		P
2.1.1.1/RD	Access to energized parts	Only SELV circuits and earthed parts are accessible	P
	Test by inspection ..... :	Only SELV circuits and earthed parts are accessible	P
	Test with test finger (Figure 2A) ..... :	No hazardous voltage accessible with the test finger	P
	Test with test pin (Figure 2B) ..... :	No hazardous voltage accessible with the test pin	P
	Test with test probe (Figure 2C) ..... :	No TNV circuits	N/A
2.1.1.2/RD	Battery compartments		N/A
2.1.1.3/RD	Access to ELV wiring	No ELV circuits	N/A
	Working voltage (Vpeak or Vrms); minimum distance through insulation (mm)	(see appended table 5.7)	—
2.1.1.4/RD	Access to hazardous voltage circuit wiring	No hazardous voltages are located in operator access area	P
2.1.1.5/RD	Energy hazards ..... :	No energy hazard in operator access area	P
2.1.1.6/RD	Manual controls	Touch screen display is not connected to ELV or hazardous voltage parts.	P

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Clause	Requirement + Test	Result - Remark	Verdict
2.1.1.7/RD	Discharge of capacitors in equipment	No operator-accessible external point of disconnection of a mains supply (permanently connected equipment with external circuit breaker).	N/A
	Measured voltage (V); time-constant (s)..... :	--	—
2.1.1.8/RD	Energy hazards – d.c. mains supply	Not connected to DC mains	N/A
	a) Capacitor connected to the d.c. mains supply ..		N/A
	b) Internal battery connected to the d.c. mains supply ..... :		N/A
2.1.1.9/RD	Audio amplifiers ..... :		N/A
5.1.2 2.1.1.5 c) /RD	Protection for UPS intended to be used in service access areas	Service is not permitted when the equipment is switched on.	N/A
	Hazardous energy level		N/A
5.1.3 2.1.1.5 c) /RD	Protection for UPS intended to be used in restricted access areas		N/A
	Hazardous energy level		N/A
5.1.4	Backfeed protection		—
	Shock hazard after de-energization of a.c. input for UPS		P
	Measured voltage (V); time-constant (s)..... :	0V, 1.2 sec	—
	Description of the construction ..... :	Backfeed protection of the equipment is provided by contactors located in the Static Switch	P
5.1.5	Emergency switching device	The equipment is provided with terminals for connection of the remote emergency switch device. When external EMO switch is operated, it disconnects the equipment output from any input source. Suitable statement in the User Manual is provided.	P
5.2	Requirements for auxiliary circuits		P
5.2.1 2.2/RD	Safety extra low voltage circuit - SELV		P

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Clause	Requirement + Test	Result - Remark	Verdict
2.2.1/RD	General requirements	Separation between hazardous voltage circuits and SELV circuits is provided by the following: - Power Module: Card 1012, transformers 29TJIXDA, 29TJIXF; Card 1013, provided by optical isolators ISO6, ISO7, Cl/Cr; - Controller Module: approved power supply with SELV outputs, including LCD touch control panel supplying circuit; - Static Switch module: Card 1776, optical isolators ISO3, ISO4, Cl/Cr.	P
2.2.2/RD	Voltages under normal conditions (V) ..... :	(See appended table 5.2.1)	P
2.2.3/RD	Voltages under fault conditions (V) ..... :	(See appended table 5.5)	P
2.2.4/RD	Connection of SELV circuits to other circuits .. :		P
5.2.2 2.3/RD	Telephone network voltage circuits - TNV	No TNV circuits	N/A
2.3.1/RD	Limits		N/A
	Type of TNV circuits..... :		—
2.3.2/RD	Separation from other circuits and from accessible parts		N/A
2.3.2.1/RD	General requirements		N/A
2.3.2.2/RD	Protection by basic insulation		N/A
2.3.2.3/RD	Protection by earthing		N/A
2.3.2.4/RD	Protection by other constructions ..... :		N/A
2.3.3/RD	Separation from hazardous voltages		N/A
	Insulation employed ..... :		—
2.3.4/RD	Connection of TNV circuits to other circuits		N/A
	Insulation employed ..... :		—
2.3.5/RD	Test for operating voltages generated externally		N/A
	Test with test probe (Figure 2C) ..... :		N/A
5.2.3 2.4/RD	Limited current circuits		N/A
2.4.1/RD	General requirements		N/A
2.4.2/RD	Limit values	(See appended table 5.2.3)	—
	Frequency (Hz) ..... :		—
	Measured current (mA) ..... :		—

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	Measured voltage (V)..... :		—
	Measured circuit capacitance (nF or µF) ..... :		—
2.4.3/RD	Connection of limited current circuits to other circuits		N/A
5.2.4 3.5/RD	External signalling circuits	The equipment is not intended for connection to other equipment.	N/A
3.5.1/RD	General requirements		N/A
3.5.2/RD	Types of interconnection circuits ..... :		N/A
3.5.3/RD	ELV circuits as interconnection circuits		N/A
3.5.4/RD	Data ports for additional equipment		N/A
5.2.5 2.5/RD	Limited power source		N/A
	a) Inherently limited output		N/A
	b) Impedance limited output		N/A
	c) Regulating network limited output under normal operating and single fault condition		N/A
	d) Overcurrent protective device limited output		N/A
	Max. output voltage (V), max. output current (A), max. apparent power (VA) ..... :		—
	Current rating of overcurrent protective device (A)		—
5.3	Protective earthing and bonding		P
5.3.1	General		P
2.6/RD	Provisions for earthing and bonding	All accessible conductive parts of modules are reliably connected to the protective earthing terminal (bus-bar) located in the side of the Mounting Rack. Each module frame is bonded to protective earthing by green/yellow conductor. Each module is bonded to its frame by protective pin (located in the frame rear enclosure) and contact secured to the module enclosure.	P
2.6.1/RD	Protective earthing		P
2.6.2/RD	Functional earthing		N/A
2.6.3/RD	Protective earthing and protective bonding conductors		P
2.6.3.1/RD	General		P

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2.6.3.2/RD	Size of protective earthing conductors		P
	Rated current (A), cross-sectional area (mm2), AWG..... :	420A, 45mm² (bus-bar 15x5mm)	—
2.6.3.3/RD	Size of protective bonding conductors		P
	Rated current (A), cross-sectional area (mm2), AWG..... :	42A per Power Module, 10mm²	—
	Protective current rating (A), cross-sectional area (mm2), AWG..... :	50A per Power Module, 10mm²	—
2.6.3.4/RD	Resistance of earthing conductors and their terminations; resistance (Ω), voltage drop (V), test current (A), duration (min)..... :	(See appended table 5.3.1)	P
2.6.3.5/RD	Colour of insulation ..... :	Green/Yellow	P
2.6.4/RD	Terminals		P
2.6.4.1/RD	General		P
2.6.4.2/RD	Protective earthing and bonding terminals	Main protective earthing bus-bar and bonding screw type terminals.	P
	Rated current (A), type, nominal thread diameter (mm)..... :	Main bus-bar 420A, 15mmx5mm, 42A, bonding screw terminal M5	—
2.6.4.3/RD	Separation of the protective earthing conductor from protective bonding conductors		P
2.6.5/RD	Integrity of protective earthing		P
2.6.5.1/RD	Interconnection of equipment	Earthing connection is assured for equipment connected to the equipment under test.	P
2.6.5.2/RD	Components in protective earthing conductors and protective bonding conductors	No switches and fuses in the protective conductors.	P
2.6.5.3/RD	Disconnection of protective earth	Permanent connection to PE.	
2.6.5.4/RD	Parts that can be removed by an operator	Protective earthing connection makers earlier and breaks later than the phase connection when the Power Module or Controller Module is removed or inserted.	P
2.6.5.5/RD	Parts removed during servicing		P
2.6.5.6/RD	Corrosion resistance	No risk of corrosion (combination Zink on steel/aluminium is used).	P
2.6.5.7/RD	Screws for protective bonding	No self-tapping and spaced thread screws are used for bonding connection.	P
2.6.5.8/RD	Reliance on telecommunication network or cable distribution system		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
5.3.2 2.6.1/RD	Protective earthing		P
2.10/RD	Clearances, creepage distances and distances through insulation		P
4.2/RD	Mechanical strength		P
5.2/RD	Electric strength		P
5.3.3	Protective bonding		P
5.4	AC and d.c. power isolation		P
5.4.1	General		P
3.4/RD	Disconnection from the mains supply	External disconnect device is specified in the installation instructions.	P
3.4.1/RD	General requirement		P
3.4.2/RD	Disconnect devices	External circuit-breaker is used as disconnect device.	P
3.4.3/RD	Permanently connected equipment	Suitable statement in installation instruction is provided.	P
3.4.4/RD	Parts which remain energized	No such parts. External disconnect device is used.	N/A
3.4.5/RD	Switches in flexible cords		N/A
3.4.6/RD	Number of poles - single-phase and d.c. equipment	Three-phase equipment	N/A
3.4.7/RD	Number of poles - three-phase equipment	Disconnect all phase conductors simultaneity	P
3.4.8/RD	Switches as disconnect devices	Disconnect device is not incorporated in the equipment.	N/A
3.4.9/RD	Plugs as disconnect devices		N/A
3.4.10/RD	Interconnected equipment		N/A
3.4.11/RD	Multiple power sources	Separate means are provided for AC mains and external battery.	P
5.4.2	Disconnect devices	Disconnect device for AC supply is provided.	P
5.5	Overcurrent and earth fault protection		P
5.5.1	General		P
2.7.3/RD	Short-circuit backup protection	External circuit breaker and circuit breakers in each phase conductor are provided.	P

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Clause	Requirement + Test	Result - Remark	Verdict
2.7.4/RD	Number and location of protective devices ..... :	Each Phase conductor of each Power Module is protected by 50A fuse.	P
2.7.5/RD	Protection by several devices		P
2.7.6/RD	Warning to service personnel ..... :	Such warnings for service persons are not required.	N/A
5.5.2	Basic requirements	Protection provided by an external circuit breaker 420A and by: - AC input/output circuit breakers located in each Power Module; - DC input/output fuses 40A located in each Power Module	P
5.5.3	Battery circuit protection		P
5.5.3.1	Overcurrent and earth fault protection	Batteries supply circuits are protected by input/output fuses 40A located in each Power Module.	P
5.5.3.2	Location of protective device	Batteries are not installed inside the equipment.	N/A
5.5.3.3	Rating of protective device	Separate battery supply is used. Suitable rating of the over current protective device is provided in User Manual.	P
5.3.1/RD	Protection against overload and abnormal operation	(see appended table 8.3)	P
5.6	Protection of personnel – Safety interlocks		P
5.6.1	Operator protection	Safety interlocks are not used.	N/A
2.8/RD	Safety interlocks		N/A
2.8.1/RD	General principles		N/A
2.8.2/RD	Protection requirements		N/A
2.8.3/RD	Inadvertent reactivation		N/A
2.8.4/RD	Fail-safe operation		N/A
2.8.5/RD	Moving parts		N/A
2.8.6/RD	Overriding		N/A
2.8.7/RD	Switches and relays		N/A
2.8.7.1/RD	Contact gaps (mm) ..... :		N/A
2.8.7.2/RD	Overload test		N/A
2.8.7.3/RD	Endurance test		N/A
2.8.7.4/RD	Electric strength test	(see appended table 8.2)	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
2.8.8/RD	Mechanical actuators		N/A
5.6.2	Service person protection		P
5.6.2.1	Introduction		P
5.6.2.2	Covers	All hazardous voltage and moving parts are protected against unintentional contact by isolation.	P
5.6.2.3	Location and guarding of parts		P
5.6.2.4	Parts on doors	No doors	N/A
5.6.2.5	Component access	No components which require access for adjacent or maintenance.	N/A
2.8.3/RD	Inadvertent reactivation	No interlocks	N/A
5.6.2.6	Moving parts	Cooling fans are guarded	P
5.6.2.7	Capacitor banks	Residual hazardous voltage remains on the capacitors located in Power Modules. Warning marking and instructions for service personal are provided.	P
5.6.2.8	Internal batteries		N/A

5.7 2.10/RD	Clearances, creepage distances and distances through insulation		P
2.10.1/RD	General		P
2.10.1.1/RD	Frequency ..... :	50 Hz	P
2.10.1.2/RD	Pollution degrees ..... :	II	P
2.10.1.3/RD	Reduced values for functional insulation		N/A
2.10.1.4/RD	Intervening unconnected conductive parts		N/A
2.10.1.5/RD	Insulation with varying dimensions		N/A
2.10.1.6/RD	Special separation requirements		N/A
2.10.1.7/RD	Insulation in circuits generating starting pulses		N/A
2.10.2/RD	Determination of working voltage	(See appended table 5.7)	P
2.10.2.1/RD	General		P
2.10.2.2/RD	RMS working voltage		P
2.10.2.3/RD	Peak working voltage		P
2.10.3/RD	Clearances		P
2.10.3.1/RD	General		P
2.10.3.2/RD	Mains transient voltages		N/A
	a) AC mains supply ..... :		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	b) Earthed d.c. mains supplies ..... :		N/A
	c) Unearthed d.c. mains supplies ..... :		N/A
	d) Battery operation ..... :		N/A
2.10.3.3/RD	Clearances in primary circuits	(see appended table 5.7)	P
2.10.3.4/RD	Clearances in secondary circuits	(see appended table 5.7)	P
2.10.3.5/RD	Clearances in circuits having starting pulses		N/A
2.10.3.6/RD	Transients from a.c. mains supply ..... :		N/A
2.10.3.7/RD	Transients from d.c. mains supply ..... :		N/A
2.10.3.8/RD	Transients from telecommunication networks and cable distribution systems ..... :		N/A
2.10.3.9/RD	Measurement of transient voltage levels		N/A
	a) Transients from a mains supply		N/A
	For an a.c. mains supply ..... :		N/A
	For a d.c. mains supply ..... :		N/A
	b) Transients from a telecommunication network .		N/A
2.10.4/RD	Creepage distances	(see appended table 5.7)	P
2.10.4.1/RD	General		P
2.10.4.2/RD	Material group and comparative tracking index	IIIb	P
	CTI tests ..... :		—
2.10.4.3/RD	Minimum creepage distances		P
2.10.5 /RD	Solid insulation	Solid insulation is used only for basic insulation purposes.	N/A
2.10.5.1/RD	General		N/A
2.10.5.2/RD	Distances through insulation	(see appended table 5.7)	N/A
2.10.5.3/RD	Insulating compound as solid insulation		N/A
2.10.5.4/RD	Semiconductor devices		N/A
2.10.5.5/RD	Cemented joints		N/A
2.10.5.6/RD	Thin sheet material – General		N/A
2.10.5.7/RD	Separable thin sheet material		N/A
	Number of layers (pcs) ..... :		—
2.10.5.8/RD	Non-separable thin sheet material		N/A
2.10.5.9/RD	Thin sheet material – standard test procedure		N/A
	Electric strength test	(see appended table 8.2)	—
2.10.5.10 /RD	Thin sheet material – alternative test procedure		N/A
	Electric strength test	(see appended table 8.2)	—
2.10.5.11 /RD	Insulation in wound components		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
2.10.5.12 /RD	Wire in wound components		N/A
	Working voltage ..... :		—
	a) Basic insulation not under stress ..... :		N/A
	b) Basic, supplementary, reinforced insulation :		N/A
	c) Compliance with Annex U ..... :		N/A
	Two wires in contact inside wound component; angle between 45° and 90° ..... :		N/A
2.10.5.13 /RD	Wire with solvent-based enamel in wound components		N/A
	Electric strength test	(see appended table 8.2)	—
	Routine test		N/A
2.10.5.14 /RD	Additional insulation in wound components		N/A
	Working voltage ..... :		—
	- Basic insulation not under stress ..... :		N/A
	- Supplementary, reinforced insulation ..... :		N/A
2.10.6/RD	Construction of printed boards		P
2.10.6.1/RD	Uncoated printed boards		P
2.10.6.2/RD	Coated printed boards		N/A
2.10.6.3/RD	Insulation between conductors on the same inner surface of a printed board		N/A
2.10.6.4/RD	Insulation between conductors on different layers of a printed board		N/A
	Distance through insulation		N/A
	Number of insulation layers (pcs) ..... :		N/A
2.10.7/RD	Component external terminations		N/A
2.10.8/RD	Tests on coated printed boards and coated components	No coated printed boards or components	N/A
2.10.8.1/RD	Sample preparation and preliminary inspection		N/A
2.10.8.2/RD	Thermal conditioning		N/A
2.10.8.3/RD	Electric strength test	(see appended table 8.2)	—
2.10.8.4/RD	Abrasion resistance test		N/A
2.10.9/RD	Thermal cycling		N/A
2.10.10/RD	Test for Pollution Degree 1 environment and insulating compound	Pollution degree II	N/A
2.10.11/RD	Tests for semiconductor devices and cemented joints		N/A
2.10.12/RD	Enclosed and sealed parts		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
6	Wiring, connections and supply		P
6.1	General		P
6.1.1	Introduction		P
3.1/RD	General		P
3.1.1/RD	Current rating and overcurrent protection	Internal wires are adequate for the current they are intended to carry, see also appended Table 7.7. Protection is provided by an external circuit breaker specified in Installation Instructions and by circuit breakers and fuses incorporated in the equipment.	P
3.1.2/RD	Protection against mechanical damage	No sharp edges or corners.	P
3.1.3/RD	Securing of internal wiring		P
3.1.4/RD	Insulation of conductors		P
3.1.5/RD	Beads and ceramic insulators	Such insulators are not used	N/A
3.1.6/RD	Screws for electrical contact pressure		P
3.1.7/RD	Insulating materials in electrical connections		P
3.1.8/RD	Self-tapping and spaced thread screws	Not used for electrical connections.	P
3.1.9/RD	Termination of conductors	All conductors are terminated by appropriate connectors.	P
	10 N pull test		P
3.1.10/RD	Sleeving on wiring		N/A
6.1.2	Dimensions and rating of bus-bars and insulated conductors	See appended Table 4.5	P
6.2	Connection to power		P
6.2.1	General provisions for connection to power		P
3.2.2/RD	Multiple supply connections	1. Separate means are provided for AC mains and external battery.. 2. Plug connections are not used. 3. ELV circuits and Hazardous voltage circuits are not accessible to an operator.	P
3.2.3/RD	Permanently connected equipment	Set of terminals is provided in the Mains Power Connection Board and Static Switch.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	Number of conductors, diameter of cable and conduits (mm) ..... :	5-wire, cable is specified in the Installation Instructions.	—
3.2.4/RD	Appliance inlets		N/A
3.2.5/RD	Power supply cords	Not supplied with the equipment.	N/A
3.2.5.1/RD	AC power supply cords		N/A
	Type ..... :		—
	Rated current (A), cross-sectional area (mm²), AWG ..... :		—
3.2.5.2/RD	DC power supply cords		N/A
3.2.6/RD	Cord anchorages and strain relief		N/A
	Mass of equipment (kg), pull (N) ..... :		—
	Longitudinal displacement (mm) ..... :		—
3.2.7/RD	Protection against mechanical damage		N/A
3.2.8/RD	Cord guards		N/A
	Diameter or minor dimension D (mm); test mass (g) ..... :		—
	Radius of curvature of cord (mm) ..... :		—
6.2.2	Means of connection ..... :	Set of terminals for permanent connection to AC mains.	P
	More than one supply connection ..... :	The means of connection to AC mains and to external batteries are not interchangeable. Terminal contacts are not hazardous live when disconnected from supply.	P

6.3	Wiring terminals for external power conductors		P
3.3/RD	Wiring terminals for connection of external conductors		P
3.3.1/RD	Wiring terminals		P
3.3.2/RD	Connection of non-detachable power supply cords		N/A
3.3.3/RD	Screw terminals	Certified terminals are used.	P
3.3.4/RD	Conductor sizes to be connected		P
	Rated current (A), cord/cable type, cross-sectional area (mm2) ..... :	AC Input: 420A, 2x70mm²; AC Output: 360A, 2x70mm²	—
3.3.5/RD	Wiring terminal sizes		P
	Rated current (A), type, nominal thread diameter (mm) ..... :	AC Input: 420A, bolt, M10; AC Output: 360A, bolt, M10	—

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Clause	Requirement + Test	Result - Remark	Verdict
3.3.6/RD	Wiring terminal design	Certified terminals are used.	P
3.3.7/RD	Grouping of wiring terminals		P
3.3.8/RD	Stranded wire		P
7	Physical requirements		P
7.1	Enclosure	The equipment enclosure complies with the requirements for fire, electrical and mechanical enclosures.	P
7.2 4.1/RD	Stability		P
	Angle of 10°		P
	Test force (N) ..... :	250N	P
7.3 4.2/RD	Mechanical strength		P
4.2.1/RD	General		P
4.2.2/RD	Steady force test, 10 N		—
4.2.3/RD	Steady force test, 30 N		P
4.2.4/RD	Steady force test, 250 N		P
4.2.5/RD	Impact test		P
	Fall test		P
	Swing test		P
4.2.6/RD	Drop test; height (mm) ..... :		N/A
4.2.7/RD	Stress relief test	Metal enclosure	—
4.2.8/RD	Cathode ray tubes		N/A
	Picture tube separately certified ..... :		—
4.2.9/RD	High pressure lamps		N/A
4.2.10/RD	Wall or ceiling mounted equipment; force (N) . :		N/A
7.4	Construction details		P
7.4.1	Introduction		P
4.3.1/RD	Edges and corners	No sharp edges or corners	P
4.3.2/RD	Handles and manual controls; force (N) ..... :	--	N/A
4.3.3/RD	Adjustable controls		N/A
4.3.4/RD	Securing of parts	All screws are provided with lock washers.	P

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Clause	Requirement + Test	Result - Remark	Verdict
4.3.5/RD	Connection by plugs and sockets	IEC60320 connections are not used for SELV circuits.	P
4.3.7/RD	Heating elements in earthed equipment	No heating elements	N/A
4.3.11/RD	Containers for liquids or gases		N/A
4.4/RD	Protection against hazardous moving parts	All fans impellers are adequately guarded.	P
4.4.1/RD	General		P
4.4.2/RD	Protection in operator access areas ..... :		P
4.4.3/RD	Protection in restricted access locations ..... :		N/A
4.4.4/RD	Protection in service access areas		N/A
4.5/RD	Thermal requirements		P
4.5.1/RD	General		P
4.5.2/RD	Temperature tests		P
	Normal load condition per Annex L ..... :	Maximum normal load: continuous operation with resistive load of 245 kW (according to the manufacturer's specification)	P
4.5.3/RD	Temperature limits for materials		P
4.5.4/RD	Touch temperature limits		P
4.5.5/RD	Resistance to abnormal heat ..... :	(see appended table 7.4)	P

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Clause	Requirement + Test	Result - Remark	Verdict
7.4.2	Openings	Power Module: Front panel - set of 15 horizontal openings 7x120mm; Rear panel – set of 29x9 openings 10x10mm. Controller Module: Top panel – set of 3x18 openings 2.5x30mm; opening Ø60mm for fan guard; Front panel – set of hexagonal openings 4.0mm over an area 60x60mm (fan guard); Rear panel – set of 2x37 opening 2.5x30mm. Static Switch: Left and right side panels – set of 3x15 openings 2x30mm. Left and right sides of top cover – 2x4 openings 2x30mm. Top panel of the Controller Module is covered by Power Module bottom without openings with distance approx. 10mm. There are no openings vertically above parts at hazardous voltage.	P
7.4.3	Gas Concentration	There are no batteries within the equipment.	N/A
7.4.4	Equipment movement	Test of 250N was done. No movement of the equipment was noted.	P

7.5 4.7/RD	Resistance to fire		P
4.7.1/RD	Reducing the risk of ignition and spread of flame		P
	Method 1, selection and application of components wiring and materials	(see appended table 7.5)	P
	Method 2, application of all of simulated fault condition tests	(see appended table 7.5)	N/A
4.7.2/RD	Conditions for a fire enclosure	Fire enclosure is required	P
4.7.2.1/RD	Parts requiring a fire enclosure	All parts of modules	P
4.7.2.2/RD	Parts not requiring a fire enclosure		N/A
4.7.3/RD	Materials		P
4.7.3.1/RD	General		P

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Clause	Requirement + Test	Result - Remark	Verdict
4.7.3.2/RD	Materials for fire enclosures	Metal enclosure for all modules	P
4.7.3.3/RD	Materials for components and other parts outside fire enclosures	Side covers of the mounting rack are metal.	P
4.7.3.4/RD	Materials for components and other parts inside fire enclosures	All components are frame rated min. V-2 and mounted on PCB rated min. V-1.	P
4.7.3.5/RD	Materials for air filter assemblies		N/A
4.7.3.6/RD	Materials used in high-voltage components		N/A
7.6	Battery location	External battery is not supplied with equipment	N/A
7.6.1	Battery location and installation		N/A
7.6.2	Accessibility and maintainability		N/A
7.6.3	Distance		N/A
7.6.4	Case insulation		N/A
7.6.5	Wiring		N/A
7.6.6	Electrolyte spillage		N/A
7.6.7	Ventilation		N/A
7.6.8	Charging voltage		N/A
7.7	Temperature rise		P
4.5/RD	Thermal requirements		P
4.5.1/RD	General		P
4.5.2/RD	Temperature tests	(see appended table 7.7)	P
	Normal load condition per Annex L ..... :	Maximum normal load: continuous operation with resistive load of 245 kW (according to the manufacturer's specification)	P
4.5.3/RD	Temperature limits for materials		P
4.5.4/RD	Touch temperature limits		P
4.5.5/RD	Resistance to abnormal heat ..... :		P
8	Electrical requirements and simulated abnormal conditions		P
8.1	General provisions for earth leakage		P
5.1.1/RD	General		P

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Clause	Requirement + Test	Result - Remark	Verdict
5.1.7/RD	Equipment with touch current exceeding 3,5 mA	Measured protective conductor current was 300mA and does not exceed 5% of input current. Warning label is provided. Cross-section area of protective conductor is 45mm^2. The equipment is permanently connected.	P
8.2 5.2/RD	Electric strength		P
5.2.1/RD	General	(see appended table 8.2)	P
5.2.2/RD	Test procedure	(see appended table 8.2)	P
8.3	Abnormal operating and fault conditions		P
8.3.1	General		P
5.3.1/RD	Protection against overload and abnormal operation	(see appended table 8.3)	P
5.3.2/RD	Motors	(see appended Annex B)	N/A
5.3.3/RD	Transformers	(see appended Annex C)	P
5.3.4/RD	Functional insulation ..... :	Functional insulation was shorted	P
5.3.5/RD	Electromechanical components	Certified cooling fans	P
5.3.9/RD	Compliance criteria for abnormal operating and fault conditions	No fire occurred, no molten metal was emitted. No breakdown during electric strength test.	P
8.3.2	Simulation of faults		P
8.3.3	Conditions for tests	The appliance was operated at rated voltage.	P
9 6/RD	Connection to telecommunication networks		N/A
6.1/RD	Protection of telecommunication network service persons, and users of other equipment connected to the network, from hazards in the equipment		N/A
6.1.1/RD	Protection from hazardous voltages		N/A
6.1.2/RD	Separation of the telecommunication network from earth		N/A
6.1.2.1/RD	Requirements		N/A
	Supply voltage (V) ..... :		—
	Current in the test circuit (mA) ..... :		—
6.1.2.2/RD	Exclusions ..... :		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
6.2/RD	Protection of equipment users from overvoltages on telecommunication networks		N/A
6.2.1/RD	Separation requirements		N/A
6.2.2/RD	Electric strength test procedure		N/A
6.2.2.1/RD	Impulse test	(see appended table 9)	N/A
6.2.2.2/RD	Steady-state test	(see appended table 9)	N/A
6.2.2.3/RD	Compliance criteria		N/A
6.3/RD	Protection of the telecommunication wiring system from overheating		N/A
	Max. output current (A) ..... :		—
3.5/RD	Interconnection of equipment		N/A
3.5.1/RD	General requirements		N/A
3.5.2/RD	Types of interconnection circuits ..... :		N/A
3.5.3/RD	ELV circuits as interconnection circuits		N/A
3.5.4/RD	Data ports for additional equipment		N/A
2.1.3/RD	Protection in restricted access locations		N/A
2.3.1/RD	Limits		N/A
	Type of TNV circuits..... :		—
2.3.2/RD	Separation from other circuits and from accessible parts		N/A
2.3.2.1/RD	General requirements		N/A
2.3.2.2/RD	Protection by basic insulation		N/A
2.3.2.3/RD	Protection by earthing		N/A
2.3.2.4/RD	Protection by other constructions ..... :		N/A
2.3.3/RD	Separation from hazardous voltages		N/A
	Insulation employed ..... :		—
2.3.4/RD	Connection of TNV circuits to other circuits		N/A
	Insulation employed ..... :		—
2.3.5/RD	Test for operating voltages generated externally		N/A
2.6.5.8/RD	Reliance on telecommunication network or cable distribution system		N/A
2.10.3.3/RD	Clearances in primary circuits	(see appended table 5.7)	N/A
2.10.3.4/RD	Clearances in secondary circuits	(see appended table 5.7)	N/A
2.10.4/RD	Creepage distances		N/A
2.10.4.1/RD	General		N/A
2.10.4.2/RD	Material group and comparative tracking index		N/A
	CTI tests..... :		—
2.10.4.3/RD	Minimum creepage distances		N/A
M/RD	ANNEX M, CRITERIA FOR TELEPHONE RINGING SIGNALS (see 2.3.1/RD)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
M.1/RD	Introduction		N/A
M.2 /RD	Method A		N/A
M.3/RD	Method B		N/A
M.3.1/RD	Ringing signal		N/A
M.3.1.1/RD	Frequency (Hz) ..... :		—
M.3.1.2/RD	Voltage (V) ..... :		—
M.3.1.3/RD	Cadence; time (s), voltage (V) ..... :		—
M.3.1.4/RD	Single fault current (mA) ..... :		—
M.3.2/RD	Tripping device and monitoring voltage ..... :		N/A
M.3.2.1/RD	Conditions for use of a tripping device or a monitoring voltage		—
M.3.2.2/RD	Tripping device		N/A
M.3.2.3/RD	Monitoring voltage (V) ..... :		N/A
A/RD	Annex A, Tests for resistance to heat and fire		N/A
A.1/RD	Flammability test for fire enclosures of movable equipment having a total mass exceeding 18 kg, and of stationary equipment (see 4.7.3.2/RD)		N/A
A.1.1/RD	Samples ..... :		—
	Wall thickness (mm)..... :		—
A.1.2/RD	Conditioning of samples; temperature (°C) ..... :		N/A
A.1.3/RD	Mounting of samples ..... :		N/A
A.1.4/RD	Test flame (see IEC 60695-11-3)		N/A
	Flame A, B, C or D ..... :		—
A.1.5/RD	Test procedure		N/A
A.1.6/RD	Compliance criteria		N/A
	Sample 1 burning time (s)..... :		—
	Sample 2 burning time (s)..... :		—
	Sample 3 burning time (s)..... :		—
A.2/RD	Flammability test for fire enclosures of movable equipment having a total mass not exceeding 18 kg, and for material and components located inside fire enclosures (see 4.7.3.2/RD and 4.7.3.4/RD)		N/A
A.2.1/RD	Samples, material ..... :		—
	Wall thickness (mm)..... :		—
A.2.2/RD	Conditioning of samples; temperature (°C) ..... :		N/A
A.2.3/RD	Mounting of samples ..... :		N/A
A.2.4/RD	Test flame (see IEC 60695-11-4)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	Flame A, B or C ..... :		—
A.2.5/RD	Test procedure		N/A
A.2.6/RD	Compliance criteria		N/A
	Sample 1 burning time (s) ..... :		—
	Sample 2 burning time (s) ..... :		—
	Sample 3 burning time (s) ..... :		—
A.2.7/RD	Alternative test acc. to IEC 60695-11-5, cl. 5 and 9		N/A
	Sample 1 burning time (s) ..... :		—
	Sample 2 burning time (s) ..... :		—
	Sample 3 burning time (s) ..... :		—
A.3/RD	Hot flaming oil test (see 4.6.2/RD)		N/A
A.3.1/RD	Mounting of samples		N/A
A.3.2/RD	Test procedure		N/A
A.3.3/RD	Compliance criterion		N/A
B/RD	Annex B, Motor tests under abnormal conditions (see 4.7.2.2/RD and 5.3.2/RD)		N/A
B.1/RD	General requirements		N/A
	Position ..... :		—
	Manufacturer ..... :		—
	Type ..... :		—
	Rated values ..... :		—
B.2/RD	Test conditions		N/A
B.3/RD	Maximum temperatures		N/A
B.4/RD	Running overload test		N/A
B.5/RD	Locked-rotor overload test		N/A
	Test duration (days) ..... :		—
	Electric strength test: test voltage (V) ..... :		—
B.6/RD	Running overload test for d.c. motors in secondary circuits		N/A
B.6.1/RD	General		N/A
B.6.2/RD	Test procedure		N/A
B.6.3/RD	Alternative test procedure		N/A
B.6.4/RD	Electric strength test; test voltage (V) ..... :		N/A
B.7/RD	Locked-rotor overload test for d.c. motors in secondary circuits		N/A
B.7.1/RD	General		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
B.7.2/RD	Test procedure		N/A
B.7.3/RD	Alternative test procedure		N/A
B.7.4/RD	Electric strength test; test voltage (V) ..... :		N/A
B.8/RD	Test for motors with capacitors		N/A
B.9/RD	Test for three-phase motors		N/A
B.10/RD	Test for series motors		N/A
	Operating voltage (V) ..... :		—
C/RD	Annex C, Transformers (see 1.5.4/RD and 5.3.3/RD)		P
	Position ..... :	T1, T2, T4 (Card 1012, Power Module) T1 (Card 1776, Static Switch Module)	—
	Manufacturer ..... :	Gamatronic	—
	Type ..... :	Power Module: T1, T2 - 29TJIXDA; T4 - 29TJIXF; Static Switch: 29TJIX.	—
	Rated values ..... :	3000Vac between Primary and Secondary winding	—
	Method of protection ..... :	29TJIXDA T1, T2 (Card 1012 Power Module): overcurrent protection is provided by three independent methods: fuses in Primary, thermal cut-off 85°C, and consumption current feedback. 29TJIXF T4 (Card 1012 Power Module): overcurrent protection is provided by two independent methods: fuse in Primary and thermal cut-off 85°C. T1 (Card 1776 Static Switch Module): overcurrent protection is provided by two independent methods: fuse in Primary and consumption current feedback.	—
C.1/RD	Overload test	See table 5.5 and 8.3	P
C.2/RD	Insulation		P
	Protection from displacement of windings ..... :	Margins are provided	P

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Clause	Requirement + Test	Result - Remark	Verdict
D/RD	Annex D, Measuring instruments for touch current tests (see 5.1.4/RD)		P
D.1/RD	Measuring instrument	Simpson 228. Measuring scheme in accordance with Figure D.1 of the Standard.	P
D.2/RD	Alternative measuring instrument		N/A
E/RD	Annex E, Temperature rise of a winding (see 1.4.13/RD)		N/A
F/RD	Annex F, Measurements of clearances and creepage distance (see 2.10/RD and Annex G/RD)		P
G/RD	Annex G, Alternative method for determining minimum clearances		N/A
G.1/RD	Clearances		N/A
G.1.1/RD	General		N/A
G.1.2/RD	Summary of the procedure for determining minimum clearances		N/A
G.2/RD	Determination of mains transient voltage (V)		N/A
G.2.1/RD	AC mains supply ..... :		N/A
G.2.2/RD	Earthed d.c. mains supplies ..... :		N/A
G.2.3/RD	Unearthed d.c. mains supplies ..... :		N/A
G.2.4/RD	Battery operation ..... :		N/A
G.3/RD	Determination of telecommunication network transient voltage (V) ..... :		N/A
G.4/RD	Determination of required withstand voltage (V)		N/A
G.4.1/RD	Mains transients and internal repetitive peaks :		N/A
G.4.2/RD	Transients from telecommunication networks . :		N/A
G.4.3/RD	Combination of transients		N/A
G.4.4/RD	Transients from cable distribution systems		N/A
G.5/RD	Measurement of transient voltages (V)		N/A
	a) Transients from a mains supply		N/A
	For an a.c. mains supply		N/A
	For a d.c. mains supply		N/A
	b) Transients from a telecommunication network		N/A
G.6/RD	Determination of minimum clearances ..... :		N/A
H	Annex H, Guidance on protection against ingress of water and foreign objects (see IEC 60529)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
I	Annex I, Backfeed protection test		P
I.1	General		P
I.2	Test for pluggable UPS		N/A
I.3	Test for permanently connected UPS		P
I.4	Load-induced change of reference potential		N/A
I.5	Solid-state backfeed protection (see clause 7.1-7.5 of IEC 62040-2 and clause 7.1-7.2 of IEC 62040-3)		N/A
J/RD	Annex J, Table of electrochemical potentials (see 2.6.5.6/RD)		P
	Metal(s) used ..... :	Aluminium / Zn plated steel (0.15V)	—
K/RD	Annex K, Thermal controls (see 1.5.3/RD and 5.3.8/RD) Certified thermal switch is used		N/A
K.1/RD	Making and breaking capacity		N/A
K.2 /RD	Thermostat reliability; operating voltage (V) ... :		N/A
K.3/RD	Thermostat endurance test; operating voltage (V) ..... :		N/A
K.4/RD	Temperature limiter endurance; operating voltage (V) ..... :		N/A
K.5/RD	Thermal cut-out reliability		N/A
K.6/RD	Stability of operation		N/A
L	Annex L, Reference loads		P
L.1	General		P
L.2	Reference resistive load	Maximum normal load: continuous operation with resistive load of 245 kW (according to the manufacturer's specification)	P
L.3	Reference inductive-resistive load		—
L.4	Reference capacitive-resistive loads		N/A
L.5	Reference non-linear load		N/A
L.5.1	Test method		N/A
L.5.2	Connection of the non-linear reference load		—

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Clause	Requirement + Test	Result - Remark	Verdict
M	Annex M, Ventilation of battery compartments		N/A
M.1	General		N/A
M.2	Normal conditions		N/A
M.3	Blocked conditions		N/A
M.4	Overcharge conditions		N/A
N	Annex N, Minimum and maximum cross-sections of copper conductors suitable for connection (see 6.3)		P
U/RD	Annex U, Insulated winding wires for use without interleaved insulation (see 2.10.5.4/RD)		N/A
			—
V/RD	Annex V, AC POWER DISTRIBUTION SYSTEMS (see 1.6.1/RD)		P
V.1/RD	Introduction		P
V.2/RD	TN power distribution systems		P

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Clause	Requirement + Test	Result - Remark	Verdict

4.5	TABLE: List of critical components	P

Object/part no.	Manufacturer/ trademark	Type/model	Technical data	Standard	Mark(s) of conformity [1.]
Mounting Rack					
Power wiring	Various	Various	10 mm², 600V, 105ºC		VDE, UL
Flat cable	DON Connex Electronics	L02 series (UL 2651 Style)	28 AWG, 300V, 105ºC, VW-1		UL, E162690
Bus-bar	Gamatronic	2MCM625N	Aluminium, 15x5x1100 mm	--	--
Interface board PCB of the PC1719, PC1720	Various	Various	V-0, 105ºC		UL
Power connector assembly	ANDERSON	Powerpole 75	Contact 5900 series: 6-12AWG, 600V Housing 1300 series: V-0, 105ºC		UL, E26226
Single female contact for grounding	Hamehaber Hamekasher	4610	Plated metal, 50A		tested
LCD touch screen	Various	Various	5Vdc		--
Power Module					
Circuit breaker S101-S102	ABB	S200-C50	480/277Vac, 50A, characteristic C, 70ºC		VDE, UL
Fan	MINEBEA	4715KL-07W	48Vdc, 0.2A, 118CFM		UL, E89936
PCB	Various	Various	V-0, 130ºC		UL
Card PC1010					
Fuse F1, F2	HINODE	660GH-40UL	600Vac/dc, 40A		UL
Relay K1-K10	OMRON	G8P-1AP	Coil: 24Vdc, 36mA Contact: 30A, 277Vac 2500Vac coil /contact, 105ºC		UL, VDE
X capacitor C5-C7	SAMWHA	SCE2E type	1000pF or 4700pF, 250Vac, Y2, 85ºC		UL, VDE
Capacitor C1, C2, C3	CHUANG GE ELECTRONIC	CBB61	250Vac, 20 µF, 85ºC		UL
Varistor RV-1 - RV-3	THINKING	TVR20621	395V, 6.5kA, 220J, 85ºC		UL, VDE

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Clause	Requirement + Test	Result - Remark	Verdict

Object/part no.	Manufacturer/ trademark	Type/model	Technical data	Standard	Mark(s) of conformity [1.]
Current transformer L2, L4, L6	GAMATRONIC	29TEMF	Wire: Pr. 2.0mm, INVEX Sec. 0.16mm INVEX Bobbin: M-EI 35/18/2ST, FORMERS, 2 section, 130ºC, V-0 Insulation tape: IT7007, IDEAL TAPE, 2.5mil (0.063mm), 155ºC, 5000Vac. Withstand voltage PR/SEC 3000Vac.		UL approved materials, tested in appliance
Choke L1, L3, L5	GAMATRONIC	29TEMX-TK	Wire: 1.8mm, INVEX, 180ºC. Insulation tape: IT7007, IDEAL TAPE, 2.5mil (0.063mm), 155ºC, 5000Vac.		UL approved materials
Connector P2	ANYTEC	GPCWM03	20A, 300Vac, 105ºC, V-0		UL, VDE
Card PC 1011:					
Relay K1-K6	OMRON	G8P-1AP	Coil: 24Vdc, 36mA Contact: 30A, 277Vac 2500Vac coil /contact, 105ºC		UL, VDE
X capacitor C2-C5	SAMWHA	SCE2E type	4700pF, 250Vac, Y2, 85ºC		UL, VDE
Varistor RV-1 - RV-4	HITANO	VCR-20D681K	420V, 6.5kA, 230J, 85ºC		UL, VDE
Current transformer L2, L4, L6	GAMATRONIC	29TEMF	Wire: Pr. 2.0mm, INVEX Sec. 0.16mm INVEX Bobbin: M-EI 35/18/2ST, FORMERS , 2 section, 130ºC, V-0 Insulation tape: IT7007,IDEAL TAPE, 2.5mil (0.063mm), 155ºC, 5000Vac. Withstand voltage PR/SEC 3000Vac.		UL approved materials, tested in appliance

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Clause	Requirement + Test	Result - Remark	Verdict

Object/part no.	Manufacturer/ trademark	Type/model	Technical data	Standard	Mark(s) of conformity [1.]
Current transformer T1-T6	GAMATRONIC	G9TEXD	Wire: Pr. 1.0mm, INVEX Sec. 0.2mm INVEX Bobbin: LODESTON, EFD type, V-0, 150ºC		UL approved materials, tested in appliance
Voltage measuring transformer T7-T9	THAI LIN	TL30D-090-083	Input: 230Vac, 50Hz, 20 mA; Output: 9Vac, 83mA Dielectric strange: Pr/Sec 3750Vac		TUV
Choke L1, L3, L5	GAMATRONIC	29TEMX-TK	Wire: 1.8mm, INVEX, 180ºC. Insulation tape: IT7007,IDEAL TAPE, 2.5mil (0.063mm), 155ºC, 5000Vac.		UL approved materials
Card 1012:					
Connector P1	ANYTEC	GPCWM06	300Vac, 20A, 105ºC, V-0		UL, VDE
Fuse R311-314	Littelfuse	372 series	1A, 250V, Time-lag		UL, VDE
(Alternative)	Bussmann	SR-5 series	1A, 250V, Time-lag		UL, VDE
Relay K1 (fan circuits)	NINGBO	JRC-19F 2C 3V 02	Coil: 24Vdc, 0.2W; Contact: 30Vdc, 2A Coil/contact 1000Vac, 70ºC		TUV, UL
Thermal protector SW1, SW2	MULLER	AM-01	250Vac, 2.5A, 85ºC		UL, VDE
Optical isolator (fans control circuits)	FAIRCHILD	H11L1M	Double protection, 3500Vac.		UL, E90700

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Clause	Requirement + Test	Result - Remark	Verdict

Object/part no.	Manufacturer/ trademark	Type/model	Technical data	Standard	Mark(s) of conformity [1.]
Transformer T1, T2	GAMATRONIC	29TJIXDA	Input: 400V, 0.17A; Output: T1 – 8Vac, 0.09A; 8Vac, 1.0A; 13Vac, 0.3A; T2 - 8Vac, 0.56A 8Vac, 1.0A, 13Vac, 0.22A Wire: Pr. 0.16mm, Pacific Sec. 0.16mm, Pacific, 0.4mm, Totoku. Bobbin: EB30-P1212-F, Tokin, 1 section, 130ºC, V-0 Insulation tape: 1350F,IDEAL TAPE, 3.2mil (0.088mm), 130ºC, 7000Vac. PR/SEC 3000Vac (to SELV winding A -B).		UL approved materials, tested in appliance
Transformer T4	GAMATRONIC	29TJIXF	Input: 400V, 0.15A Output: 34V, 60W Wire: Pr. 0.32mm, Pacific Sec. 0.4mm Pacific, 0.4mm, Totoku. Bobbin: EB30-P1212-F, Tokin, 1 section, 130ºC, V-0 Insulation tape: 1350F,IDEAL TAPE, 3.2mil (0.088mm), 130ºC, 7000Vac. PR/SEC 1500Vac		UL approved materials, tested in appliance
PC1021:					
Varistor RV1-RV-6	COSONIC	CNR-20D301K	300V, 6.5kA, 220J, 85ºC		UL, VDE
Capacitor C1, C3, C7, C8, C11-C28	Various	Various	330µF, 450V, 105ºC		VDE
IGBT module	MICROSEMI	APTGT100TL60	600V, 100A, 80ºC		UL, E145592
Sveeving	OMERIN	Siligaine 16F3	600V, 155ºC		UL

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Object/part no.	Manufacturer/ trademark	Type/model	Technical data	Standard	Mark(s) of conformity [1.]
PC1022					
Fuse F1, F2	HINODE	660GH-40UL	600Vac/dc, 40A,		UL
Capacitor C1-3, C7, C8, C11-C24	Various	Varios	330µF, 450V, 105ºC		VDE
IGBT module	MICROSEMI	APTGT100TL60	600V, 100A, 80ºC		UL, E145592
Controller Module					
Power supply	FSP Group	FSP180-50NIV	Input: 115/230V, 60/50Hz; Outputs: 5V, 16A; 12V, 10A; 3.3V, 16.7A; -5V, 0.2A; -12V, 0.3A; 5V, 2A. SELV, 50ºC	UL60950-1 IEC/EN 60950-1	UL, E190414 TUV, NEMKO
Fan	MINEBEA	2408NL-04W	12Vdc, 0.11A, 17.6 CFM		UL, E89936
Optical isolator (Card 2MN070A)	FAIRCHILD	H11L1M	Double protection, 3500Vac.		UL, E90700
Computer board	VIA Embeded	VB7001	120W, 45ºC		CE
PCB	Various	Various	V-0, 130ºC		UL
Static Switch Module:					
Fuse F101-F109	Bussmann	AGC series	250V, 10A		UL, E19180
Fuse holder	Bussmann	HTB-48I	250V, 20A, V-0		UL, E14853, VDE
Contactor R101	ABB	A210-30-11 series	690Vac, 350A (300A – UL),		UL, E79416, VDE
Contactor R102	ABB	A210-30-11 series	690Vac, 400A (350A – UL)		UL, E79416, VDE
Contactor R103	ABB	A210-30-11 series	690Vac, 500A (400A -UL)		UL, E79416, VDE
Fan	UNITEDPRO (XRL)	A9225H23B-TC(X1)	230Vac, 50Hz, 13W, 33 CFM		UL, VDE
Connector P118, P121	ANYTEC	TJ-3.5	300V, 10A, V-0		UL, VDE
Socket P101, P102, P107, P201, P202, P303	DEGSON	8EDGK-5.0	300Vac, 15A, V-0		UL, E228872

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Clause	Requirement + Test	Result - Remark	Verdict

Object/part no.	Manufacturer/ trademark	Type/model	Technical data	Standard	Mark(s) of conformity [1.]
Power cable	PHINO	H05VV-F	250Vac, 10A, 3x0.75mm², 90ºC, VW-1		VDE
Wiring	Various	Various	2.5mm², 16mm², 105ºC, VW-1		VDE, UL
Current transformer T101-T103	GAMATRONIC	29TEXM	Wire: 0.2mm INVEX Bobbin: 2EBK30 Insulation tape: IT7007,IDEAL TAPE, 2.5mil (0.063mm), 155ºC, 5000Vac. Withstand voltage coil/case 1500Vac.		UL, E82910
Optical isolator	FAIRCHILD	H11L1M	Double protection, 3500Vac.		UL, E90700
Card PC 1776					
Transformer T1	GAMATRONIC	29TJIX	Input: 230V, 0.15A Output: 8Vac, 0.5A 8Vac, 0.5A 16Vac, 1.0A Wire: Pr. 0.16mm, Pacific Sec. 0.16mm, Pacific, 0.32mm, Totoku. Bobbin: EB30-P1212-F, Tokin, 1 section, 130ºC, V-0 Insulation tape: 1350F,IDEAL TAPE, 3.2mil (0.088mm), 130ºC, 7000Vac. Withstand voltage PR/SEC 1000Vac		UL approved materials, tested in appliance
Connector P1, P2, P7, P13, P14, P20	ANYTEC	GPCWM series	300V, 20A, V-0		UL, VDE
Fuse F3	HOLLY FUSE	50F-010H	Quick acting, 250V, 1A		UL
Optical isolator ISO3, ISO4	FAIRCHILD	H11L1M	Double protection, 3500Vac.		UL, E90700
NTC	AMETHERM	SL12 10006	10Ω, 6A, 40J, 177ºC		CSA, CA118061
PCB	Various	Various	V-0, 130ºC		UL
Supplementary information:					

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4.6, 1.6.2/RD	TABLE: Electrical data (in normal conditions)	P

U (V)	I (A)	Irated (A)	P (W)	Fuse #	Ifuse (A)	Condition/status
207	390	420	80 100	Ext. CB	--	Phase L1/ Maximum normal load
208	400	420	82 500	Ext. CB	--	Phase L2/ Maximum normal load
207	397	420	81 600	Ext. CB	--	Phase L3/ Maximum normal load
228	356	420	80 200	Ext. CB	--	Phase L1/ Maximum normal load
230	363	420	82 700	Ext. CB	--	Phase L2/ Maximum normal load
229	359	420	81 400	Ext. CB	--	Phase L3/ Maximum normal load
251	323	420	80 300	Ext. CB	--	Phase L1/ Maximum normal load
253	329	420	82 600	Ext. CB	--	Phase L2/ Maximum normal load
252	325	420	81 200	Ext. CB	--	Phase L3/ Maximum normal load
Supplementary information: external battery charging mode with parameters V=864V, max.I=9A						

5.1.1 and 2.1.1.7/RD	TABLE: discharge of capacitors in the primary circuit	N/A

Condition	τ calculated (s)	τ measured (s)	t u→ 0V (s)	Comments
Note(s): no operator accessible connections				

5.2.1 and 2.2.2/RD	TABLE: SELV measurement (under normal conditions)	P

Transformer	Location	Voltage (max.) (V)		Voltage Limitation Component
		V peak	V d.c.	
T1	Power Module, PC1012	11.0	---	TR construction
T1, T2	Static Switch, PC1776	11.0 17.9	--- ---	TR construction
Supplementary information:				

5.2.1 and 2.2.3/RD	TABLE: SELV measurement (under fault conditions)	P

Location	Voltage (max.) (V)	Comments
Supplementary information: see Table 5.5.		

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Clause	Requirement + Test	Result - Remark	Verdict

5.2.3 and 2.4.2/RD	TABLE: Limited current circuit measurement	N/A

Location	Voltage (V)	Current (mA)	Freq. (kHz)	Limit (mA)	Comments
Supplementary information:					

5.2.5 and 2.5/RD	TABLE: Limited power source measurement		N/A
	Limits	Measured	Verdict
According to Table 2B/2C (normal condition)			
current (in A)			
apparent power (in VA)			
According to Table 2B/2C (single fault condition)			
current (in A)			
apparent power (in VA)			
Supplementary information:			

5.3.1 and 2.6.3.4/RD	TABLE: Resistance of earthing measurement		P
Location	Resistance measured (mΩ)	Comments	
From main grounding stud to single female grounding contact on **Mounting Rack**	6.0	For maximal length of the grounding conductor (upper Power Module position).	
From main grounding stud to Mounting Rack enclosure	11.0		
From main grounding stud to **Power Module** enclosure	15.0	For upper Power Module position	
From main grounding stud to **Controller Module** enclosure	11.0		
From main grounding stud to **Static Switch** enclosure	11.0		
From main grounding stud to grounding tab connector P5 on the **Static Switch** PCB PC1776	22.0		
Supplementary information:			

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Clause	Requirement + Test	Result - Remark	Verdict

5.5 and 8.3	TABLE: Abnormal operating and fault conditions		P
	Ambient temperature (°C)		—
	Power source for EUT: Manufacturer, model/type, output rating		—

Component No.	Fault	Supply voltage (V)	Test time	Fuse #	Fuse current (A)	Observation
Power Module Phase to Neutral output	Shorted	230Vac	--	50A	148 (peak)	Output circuit breaker opened in 1.5 sec. No hazard.
Power Module DC output (charging voltage)	Shorted	230Vac	--	40A	193 (peak)	Fuse F1 (Card PC1010) opened in 1 sec. No hazard.
Static Switch Contactor RA102 (bypass)	Closed during inverter operation	230Vac	--	--	--	Contactor RA101 opened immediately. Inverter is disconnected from load. No hazard.
Static Switch Triac CR101, K5, K6	Shorted	230Vac	--	--	--	Short circuit current 20.8A. Bypass operation mode activated within 2 sec. No hazard.
Power Module Card PC1012:						
Capacitor C2 (12V4 output)	Shorted	230Vac	1h	--	--	Protection of IC1 operated. Iscpeak=8A, Iscrms=3.5A. Maximal stable temperature: T1=112.5°C, PCB near FET=45.0°C. No hazard.
Capacitor C22 (12VCCpwr output)	Shorted	230Vac	1h	--	--	Protection of IC1 operated. Iscpeak=11A, Iscrms=10A. Maximal stable temperature: T1=78°C, PCB near CR18=211°C. No hazard.
Capacitor C11 (12V2 output)	Shorted	230Vac	1h	--	--	Protection of IC1 operated. Iscpeak=2A, Iscrms=1.0A. Max. stable temperature: T1=61.5°C, PCB near CR16=52.8°C. No hazard.
Capacitor C17 (20V2 output)	Shorted	230Vac	1h	--	--	Protection of IC1 operated. Iscpeak=2.5A, Iscrms=1.0A. Max. stable temperature: T1=52.8°C, PCB near CR17=46.1°C. No hazard.

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Component No.	Fault	Supply voltage (V)	Test time	Fuse #	Fuse current (A)	Observation
Capacitor C4 (20V ISO output)	Shorted	230Vac	1h	--	--	Protection of IC1 operated. Iscpeak=2.5A, Iscrms=1.6A. Max. stable temperature: T1=122ºC, PCB near CR7 = 60ºC. No hazard.
Capacitor C10 (5V ISO output)	Shorted	230Vac	1h	--	--	Protection of U1 operated. Iscpeak=0.2A, Iscrms=0.2A. Max. stable temperature: T1=91ºC, PCB near CR7 = 67ºC. No hazard.
R28 (feedback)	Disconnected	230Vac	--	--	--	Max. peak voltage in output 20Vdc – 24V. No hazard.
Capacitor C85 (24V 3 output)	Shorted	230Vac	1h	--	--	Protection of IC1 operated. Iscpeak=7.0A, Iscrms=4.7A. Max. stable temperature: T1=107.5ºC, PCB near CR43= 68.5ºC. No hazard.
Capacitor C49 (fan supply output))	Shorted	230Vac	1h	--	--	Protection of IC2 operated. Iscpeak=4.2A, Iscrms=4.0A. Max. stable temperature: PCB near Q4 = 95ºC. No hazard.
Power module Card 1013:						
Capacitor C54 (24Vdc to 5Vdc)	Shorted	230Vac	1h	--	--	Protection of IC30 operated. Iscpeak=1.5A, Iscrms=1.5A. Max. stable temperature: PCB near IC30=62.7ºC. L2=194ºC. No hazard.
Diode CR55 (24Vdc to 12Vdc)	Shorted	230Vac	1h	--	--	Iscpeak=0.18A, Iscrms=0.125A. Max. stable temperature: PCB near IC29=50.3ºC, T1=42.7ºC, L1=41.5ºC. No hazard.
Static Switch Card PC1776:						
Capacitor C118 (+12V1 output)	Shorted	230Vac	1h	--	--	Protection of IC6 operated. Iscpeak=4.0A, Iscrms=0.7A. Max. stable temperature: T1=55.0ºC, PCB near CR104=57.8ºC. No hazard.
Capacitor C129 (+12V2 output)	Shorted	230Vac	1h	--	--	Protection of IC6 operated. Iscpeak=4.2A, Iscrms=1.0A. Max. stable temperature: T1=60ºC PCB near CR108=56.8ºC. No hazard.

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Clause	Requirement + Test	Result - Remark	Verdict

Component No.	Fault	Supply voltage (V)	Test time	Fuse #	Fuse current (A)	Observation
Capacitor C135 (-12V2 output)	Shorted	230Vac	1h	--	--	Protection of IC6 operated. Iscpeak=4.1A, Iscrms=1.0A. Max. stable temperature: T1 = 60.2ºC PCB near CR113 = 57.2ºC. No hazard.
Capacitor C139 (24Vdc output)	Shorted	230Vac	1h	--	--	Protection of IC6 operated. Iscpeak=3.0A, Iscrms=0.78A. Max/ stable temperature: T1=59ºC PCB near CR=58.6ºC. No hazard.
Capacitor C139 (-12V2 output)	Shorted	230Vac	1h	--	--	Protection of IC6 operated. Iscpeak=0.4A, Iscrms=0.4A. Max.stable temperature: PCB near R297=155.3ºC. No hazard.
R281 (feedback)	Discon.	230Vac	--	--	--	Max. peak voltage in output 24Vdc – 62.3Vdc. No hazard.
Supplementary information:						

5.7 and 2.10.2/RD	Table: Working voltage measurement		P
Location	RMS voltage (V)	Peak voltage (V)	Comments
Power Module, Card 1012, transformer T1, between pins 1 (Pr) and 6 (Sec)	230	432	
Static Switch, Card 1776, transformer T1, between pin 1 (Pr) and 5 (Sec).	230	325	
Supplementary information:			

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Clause	Requirement + Test	Result - Remark	Verdict

5.7 and 2.10.4/RD	TABLE: Clearance and creepage distance measurements					P
Clearance (cl) and creepage distance (cr) at/of/between:	U peak (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	Required cr (mm)	cr (mm)
Functional:						
Power module Line to Line	565	400	2.0	8.0	4.0	8.0
Power module Line to Neutral	325	230	1.5	4.0	2.5	4.0
Static switch Line to Line	565	400	2.0	7.8	4.0	7.8
Static switch Line to Neutral	325	230	1.5	4.0	2.5	4.0
Controller Module Line to Neutral	325	230	1.5	4.0	2.5	4.0
Basic / supplementary:						
Mounting Rack L1/L2/L3/N to enclosure	325	230	1.5	5.0	2.5	6.0
Power Module L1/L2/L3/N to enclosure (from PC1010, PC1011, PC1012, PC1021, and PC1022 cards PCB mounted component leads to enclosure, minimal values).	325	230	1.5	3.0	2.5	5.5
Power module Card PC1012 From T1 pin 2 (Pr) to T1 pin 6 (Sec) tracks on PCB	432	230	1.5	4.0	2.5	4.0
Power module Card PC1012 From C85 (Pr) to CR8 (Sec, Safety Zone) tracks on PCB	432	230	1.5	8.0	2.5	8.0
Static Switch Card 1776 From T1 pin1 to T1 pin 5 track	325	230	1.5	3.0	2.5	3.0
Reinforced:						
Power Module Card 1012 From R96 (Pr) track to R5 (Safety zone) track	432	230	3.0	9.5	5.0	9.5
Static switch Card 1776 Between ISO3, ISO4 leads	325	230	3.0	7.0	5.0	7.0
Static switch Card 1776 Between pins 2 and 4 connector P8	325	230	3.0	5.0	5.0	5.0
Supplementary information:						

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Clause	Requirement + Test	Result - Remark	Verdict

5.8, 2.1.1.3/RD and 2.10.5.1 /RD	TABLE: Distance through insulation measurements	N/A

Distance through insulation (DTI) at/of:	U peak (V)	U r.m.s. (V)	Test voltage (V)	Required DTI (mm)	DTI (mm)
--	--	--	--	--	--
Supplementary information:					

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6, 8.2 and 9	TABLE: Electric strength tests, impulse tests and voltage surge tests		P
Test voltage applied between:	Voltage shape (AC, DC, impulse, surge)	Test voltage (V)	Breakdown Yes / No
Functional:			
---	---	---	---
Basic / supplementary:			
Mounting Rack L1/L2/L3/N Input/ Output to Ground	Voltage DC	2120	NO
Static Switch L1/L2/L3/N Input/ Output to Ground	Voltage DC	2120	NO
Static Switch "+"/"-" battery output to Ground	Voltage DC	2120	NO
Power Module L1/L2/L3/N Input/ Output to Ground	Voltage DC	2120	NO
Power Module "+"/"-" battery output to Ground	Voltage DC	2120	NO
Reinforced:			
Mounting Rack L1/L2/L3/N Input/Output to communication circuit	Voltage DC	4240	NO
Power Module L1/L2/L3/N Input/ Output to Internal communication circuit pins 1-4 terminal P8	Voltage DC	4240	NO
Power Module "+"/"-" battery output to Internal communication circuit pins 1-4 terminal P8	Voltage DC	4240	NO
Static Switch L1/L2/L3/N Input/Output to communication circuit	Voltage DC	4240	NO
Static Switch "+"/"-" battery output to communication circuit	Voltage DC	4240	NO
Controller Module L/N to communication circuit **(LAN)**	Voltage DC	4240	NO
Supplementary information:			

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Clause	Requirement + Test	Result - Remark	Verdict

7.4, 4.5.5/RD	TABLE: Ball pressure test of thermoplastic parts		N/A
	Allowed impression diameter (mm)	≤ 2 mm	—

Part	Test temperature (°C)	Impression diameter (mm)
Supplementary information:		

7.4.2,	Table: Enclosure opening measurements		N/A
Location	Size (mm)	Comments	
--	--	--	
Supplementary information: see Cl. 7.4.2.			

7.5	Table: Resistance to fire				N/A
Part	Manufacturer of material	Type of material	Thickness (mm)	Flammability class	Evidence
--	--	--	--	--	--
Supplementary information:					

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7.7	TABLE: Temperature test						P
	Supply voltage (V)	207	207	253	253	--	—
	Ambient T_{min} (°C)	29	40*	28	40*	--	—
	Ambient T_{max} (°C)	29	40*	28	40*	--	—

Maximum measured temperature T of part/at::	T (°C)					Allowed T_{max} (°C)
GENERAL:						
Mounting rack plastic cover	38.8	49.8	39.0	51.0	--	95
Mounting rack metal accessible part	32.7	43.7	32.8	44.8	--	70
Power module:						
AC input connector	35.3	46.3	35.2	47.2	--	85
AC input CB	45.9	56.9	49.6	61.6	--	70
AC input choke L1	75.8	86.8	82.1	94.1	--	165
AC wiring	52.1	63.1	55.3	67.3	--	105
X capacitor	48.9	59.9	53.1	65.1	--	85
DC connector P2	56.7	67.7	59.8	71.8	--	85
AC input relay K1	36.6	47.6	35.3	47.3	--	105
PCB near coil L1	33.7	44.7	34.6	46.6	--	105
DC wiring	38.8	49.8	40.9	52.9	--	105
Capacitor Electrolyte C1	35.0	46.0	35.8	47.8	--	105
AC output choke L3	40.8	51.8	45.2	57.2	--	165
Current transformer G9TEXD	35.8	46.8	37.9	49.9	--	120
Current transformer 29TEMF	38.5	49.5	43.1	55.1	--	120
AC output relay K4	45.1	56.1	49.6	61.6	--	105
AC output CB	41.8	52.8	49.0	61.0	--	70
Flat cable	32.5	43.5	33.2	45.2	--	105
AC output connector	38.5	49.5	40.6	52.6	--	85
Controller module:						
PS ambient	35.4	46.5	36.9	48.9	--	50
Internal wiring	44.2	55.2	46.3	58.3	--	105
Relay	42.7	53.7	45.0	57.0	--	70
Flat cable	42.6	53.6	44.9	56.9	--	105
Connector P5	48.1	59.1	51.8	63.8	--	85
PS output connector	44.8	55.8	47.8	59.8	--	85
Lithium battery	43.3	54.3	45.2	57.2	--	70

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Maximum measured temperature T of part/at::	T (°C)					Allowed T_{max} (°C)
PCB near processor	59.0	70.0	61.9	73.9	--	105
Static Switch module						--
CB 500A	39.4	50.4	53.0	65.0	--	70
CB plastic plate	39.2	50.2	43.4	55.4	--	90
AC Internal wiring	40.2	51.2	42.3	54.3	--	105
Tubing for flat cable	38.6	49.6	39.0	51.0	--	105
Connector "Inv s"	40.8	51.8	41.7	53.7	--	85
DC Internal wiring	41.2	52.2	43.3	55.3	--	105
Relay	50.5	61.5	54.3	66.3	--	105
Transformer T1	49.3	60.3	51.8	63.8	--	120
PCB near transformer	43.5	54.5	45.5	57.5	--	105

Supplementary information:

Temperature T of winding:	t_1 (°C)	R_1 (Ω)	t_2 (°C)	R_2 (Ω)	T (°C)	Allowed T_{max} (°C)	Insulation class

Supplementary information:

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8.3.2.	TABLE: Temperature test. Abnormal operation. A – front ventilation openings blocked. B - rear ventilation opening blocked.						P
	Supply voltage (V) .....:	230	230	230	230	--	—
	Ambient T_{min} (°C) .....:	29	40*	29	40*	--	—
	Ambient T_{max} (°C) .....:	29	40*	29	40*	--	—
	Test condition	A	A	B	B		

Maximum measured temperature T of part/at::	T (°C)					Allowed T_{max} (°C)
GENERAL:						
Mounting rack plastic cover	42.6	53.6	38.9	49.9	--	--
Mounting rack metal accessible part	35.2	46.2	33.3	44.3	--	--
Power module:						
AC input connector	49.0	60.0	36.2	47.2	--	--
AC input CB	46.2	57.2	52.1	63.1	--	--
AC input choke L1	129.6	140.6	81.1	92.1	--	265
AC wiring	68.1	79.1	55.8	66.8	--	--
X capacitor	53.0	64.0	48.7	59.7	--	--
DC connector P2	42.0	53.0	46.0	57.0	--	--
AC input relay K1	44.4	55.4	36.5	47.5	--	--
PCB near coil L1	63.0	74.0	35.3	46.3	--	--
DC wiring	75.3	86.3	39.7	50.7	--	--
Capacitor Electrolyte C1	67.1	78.1	39.9	50.9	--	--
AC output choke L3	75.0	86.0	48.9	59.9	--	265
Current transformer G9TEXD	71.8	82.8	40.9	51.9	--	215
Current transformer 29TEMF	78.3	89.3	45.1	56.1	--	215
AC output relay K4	42.5	53.5	50.0	61.0	--	--
AC output CB	42.4	53.4	47.9	58.9	--	--
Flat cable	46.8	57.8	34.9	45.9	--	--
AC output connector	49.6	60.6	43.9	54.9	--	--
Controller module:						
PS ambient	50.4	61.4	48.1	59.1	--	--
Internal wiring	50.2	61.2	47.7	58.7	--	--
Relay	48.7	59.7	46.2	57.2	--	--
Flat cable	48.6	59.6	46.3	57.3	--	--
Connector P5	56.8	67.8	53.8	64.8	--	--

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IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict

Maximum measured temperature T of part/at::	T (°C)					Allowed T_{max} (°C)
PS output connector	52.1	63.1	49.5	60.5	--	--
Battery	48.9	59.9	46.5	57.5	--	--
PCB near processor	66.3	77.3	63.6	74.6	--	--
Static Switch module						
CB 500A	67.0	78.0	63.8	74.8	--	--
CB plastic plate	46.9	57.9	44.7	55.7	--	--
AC Internal wiring	45.3	56.3	43.6	54.6	--	--
Tubing for flat cable	41.3	52.3	40.0	51.0	--	--
Connector "Inv s"	44.3	55.3	43.0	54.0	--	--
DC Internal wiring	46.1	57.1	44.6	55.6	--	--
Relay	57.5	68.5	55.7	66.7	--	--
Transformer T1	54.3	65.3	53.0	64.0	--	215
PCB near transformer	47.8	58.8	46.7	57.7	--	--

Supplementary information: self-reseting internal thermal protection of the Power module operated.
Maximum maesured temperature values for stady state conditions are specified in Table.

Temperature T of winding:	t_1 (°C)	R_1 (Ω)	t_2 (°C)	R_2 (Ω)	T (°C)	Allowed T_{max} (°C)	Insulation class

Supplementary information:

8.1	TABLE: earth leakage current			P
Condition	L→ terminal A (mA)	N → terminal A (mA)	Limit (mA)	Comments
Phase L1	21	3.6	3.5	Equipment is evaluated as equipment with high leakage current. Suitable label is provided. Also see supplementary information.
Phase L2	23	3.6	3.5	
Phase L3	23	3.6	3.5	
"+" output	3.8	--	3.5	
" – " output	3.7	--	3.5	

Supplementary information:
1) min. input current – 360A. Protective conductor current is 0.3A < 0.05*360A= 18A.

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IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict

C.2/RD	Safety isolation transformer		P
	Construction details:		
Transformer part name:		PC1012 T1/T2	
Manufacturer:	See appended table 4.3	GAMATRINIC	
Type:	See appended table 4.3	29TJIXDA	
Recurring peak voltage		432V	
Required clearance for reinforced			
insulation (from table 2H and 2J)		4.0mm	
Effective voltage rms		230V	
Required creepage distance for reinforced			
insulation (from table 2L)		5.0mm	
Measured min. creepage distance			
Location		inside (mm)	outside (mm)
Winding A-B (Secondary) to winding 1-2 (Primary)		7.0	13.5
Measured min. clearances			
Location		inside (mm)	outside (mm)
Winding A-B (Secondary) to winding 1-2 (Primary)		---	>20mm
Construction:			
Pin numbers			
Prim.		1 – 2	
Sec.		A - B	
Bobbin			
Material		PBT manufacturer by NEC TOKIN	
Thickness		2.0mm	
Electric strength test			
With AC 3000V after humidity treatment			
Result		Pass	

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IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict

M	Ventilation of battery compartments	N/A

The required dimension for the ventilation openings will be calculated with the following formula:

$A > K1 * Q$

with $Q = (0.054\ m^3/Ah) * n * I * C$

where:

K1 : constant factor of 28 h * cm^2/m^3

Q : airflow in m^3/h

n : number of battery cells

I : constant factor (0,2A/100Ah for valve regulated lead acid batteries)

C : nominal capacity of the battery

With the specific data for the UPS the following dimension for the ventilation openings is required:

n : ?

C : ?

$A > 28\ h * cm^2/m^3 * (0.054\ m^3/Ah) * n * 0.2\ A/100\ Ah * C$

$A > ?\ cm^2$

Verdict

The size of ventilation openings in battery cabinet exceeds the required airflow by far (as well as the UPS).

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List of test equipment used:

Clause	Measurement / testing	Testing / measuring equipment / material used				Range used	Calibration date	
		SII Ref. No.	Instrument Type	Manufacturer	Model		Last	Due
4.6 1.6.2.RD	Power measuremets	4875	Power Analazer	Fluke	434	auto	11/09	11/10
5.5 8.3	Current measurements	564544	DC/AC Clamp Meter	Prova Instruments	CM-01	auto	11/09	11/10
5.5 8.3	Voltage measurements	5047	True RMS Multimeter	Fluke	87 III	0-500 Vac	02/10	02/11
5.1.1 2.1.1.7RD 5.7 2.10.2RD	Current and voltage measurements	53930	Industrial Scopemeter	Fluke	DM7540064	auto	08/09	08/10
8.1	Leakage current	6420	Leakage current tester	KIKUSUI	TOS3200	auto	10/09	10/10
4.7.16 1.7.11/RD	Durability of markings	--	N-hexane	BIO-LAB	CAS # 110-54-3	--	10/07	10/12
7.2 4.1RD	Steady force test	52839	Test probe 250N	PTL	P10.64	--	06/10	06/11
3.1.2RD	Sharp edge testing	54412	Sharp Edge Tester	Underwriters Laboratories	Set-50	--	08/09	31/08/10
5.5 7.7 8.3.2.	Temperature measurements	5005 53934 564521	Data Acquisition/Switch Unit with Thermocouples Type J 20-Channel Armature Multiplexer 20-Channel Armature Multiplexer	Agilent	34970A S/N US37030301 34901A S/N US37242806 34901A S/N US37257353	auto	11/09	11/10
5.5 7.7 8.3.2.	Temperature measurements	563019	Stopwatch / Timer	Extech Instruments	365528	auto	10/09	10/10
6. 8.2 9	Electric strength tests	5971	AC/DC Withstand Voltage Tester	Associated Research	3670	auto	08/09	08/10
5.3.1 2.6.3.4RD	Grounding bonding resistance	5972	Ground Bond Tester	Associated Research	3140	auto	08/09	08/10
5.7 2.10.4RD 7.4.2	Mechanical measurements	52697	Digital Caliper	Mitutoyo	CD-6"R	--	07/10	07/11

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APPENDIX 1
PHOTOGRAPHS

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Fig. 1
General view of the system

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Fig. 2
Power Module – overall external views

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Fig. 3
Power Module internal view

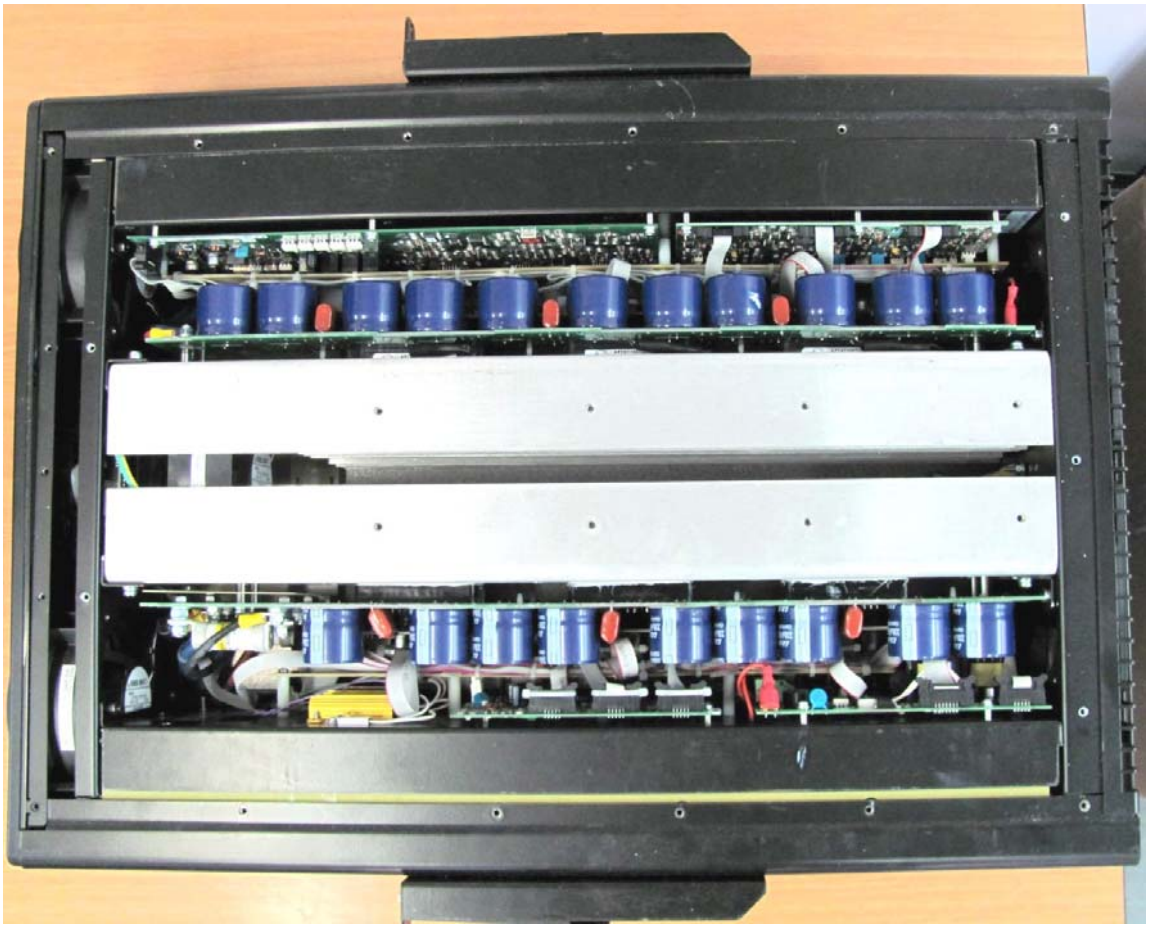

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Fig. 4
Controller – overall external views

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Fig. 5
Controller – internal view

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Fig. 6
Static Switch – overall external views

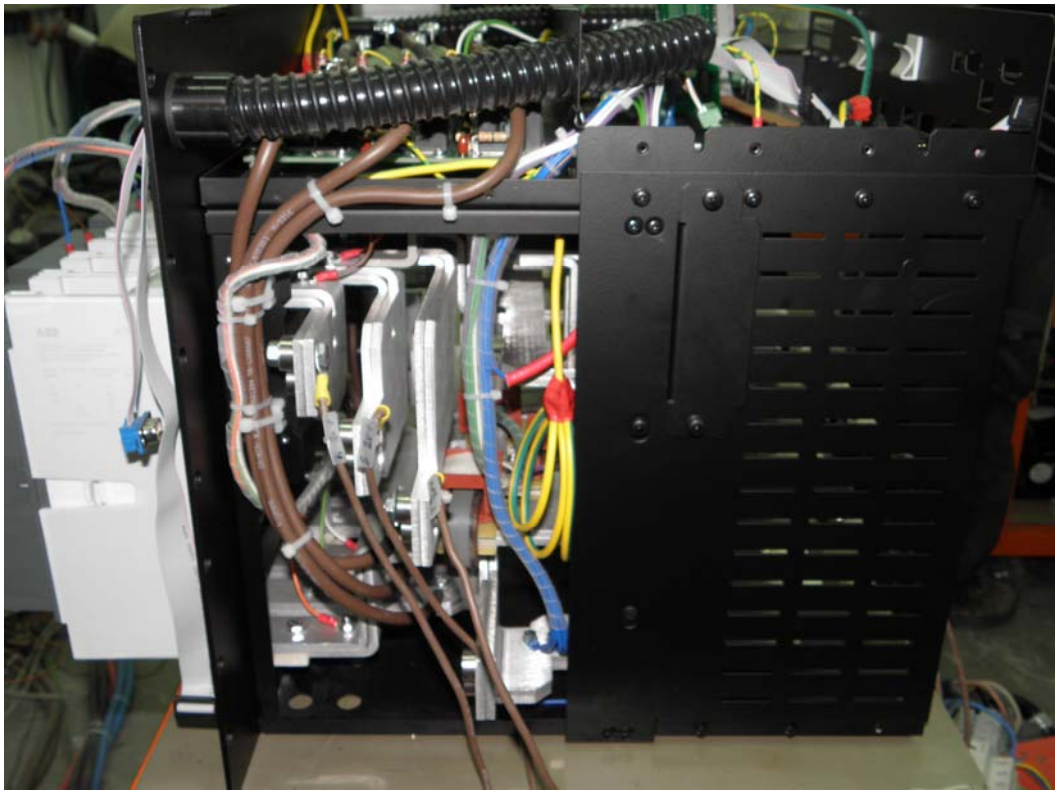

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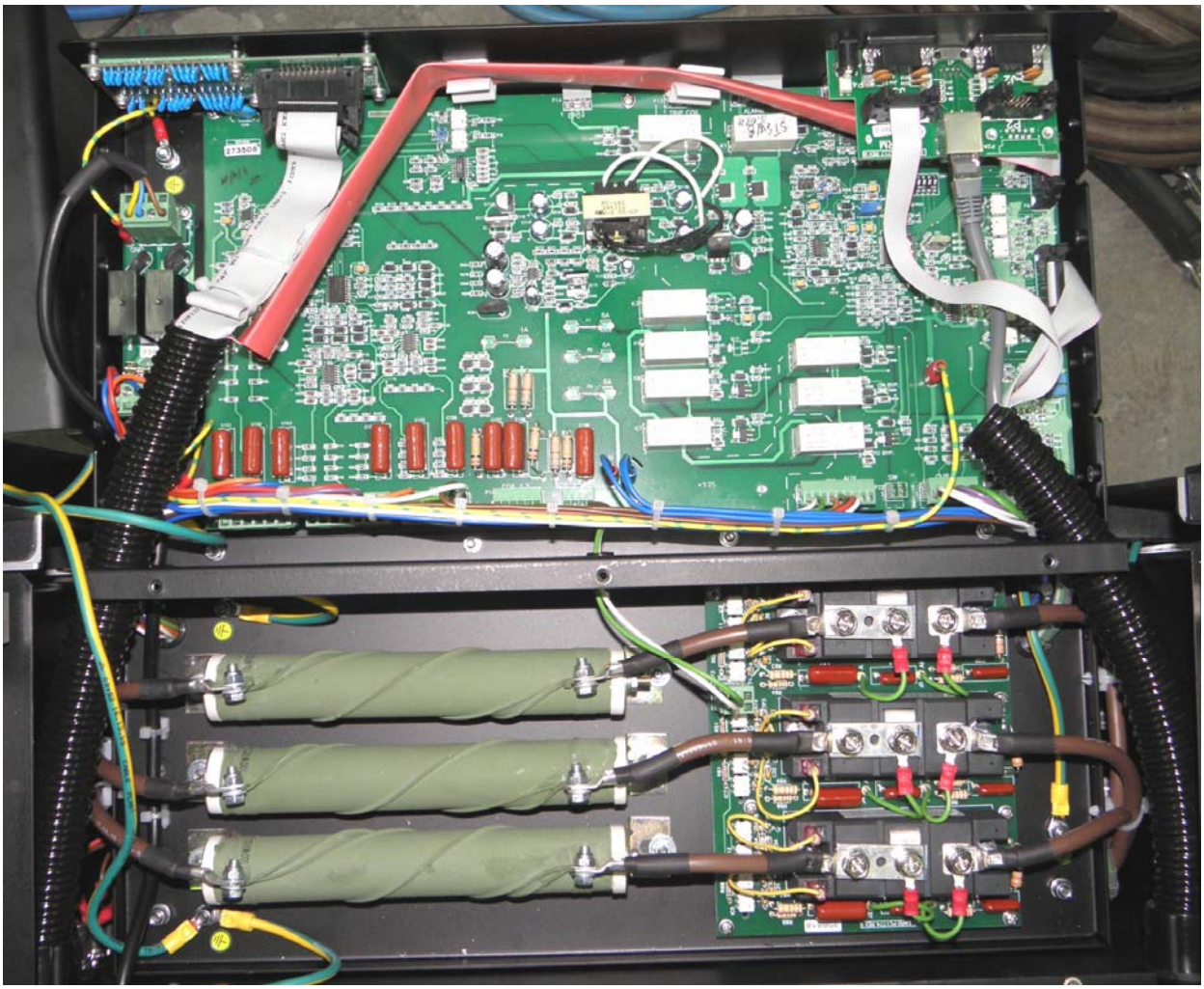
Fig. 7
Static switch – internal view



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APPENDIX 2
ELECTRICAL SCHEMATICS

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Fig. 1
Controller

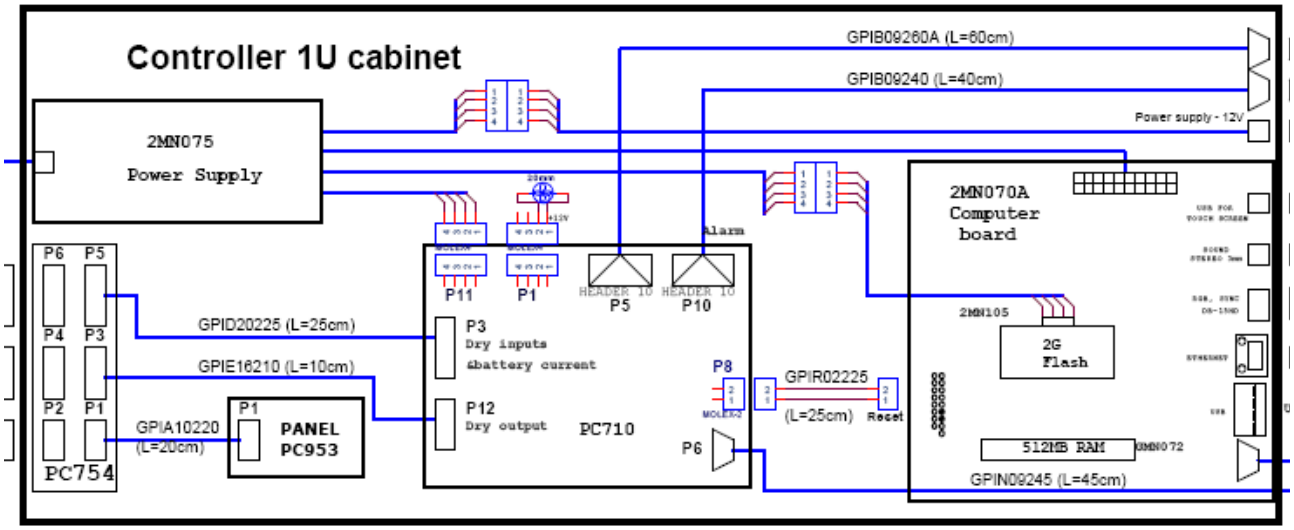

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Fig. 2
Static switch

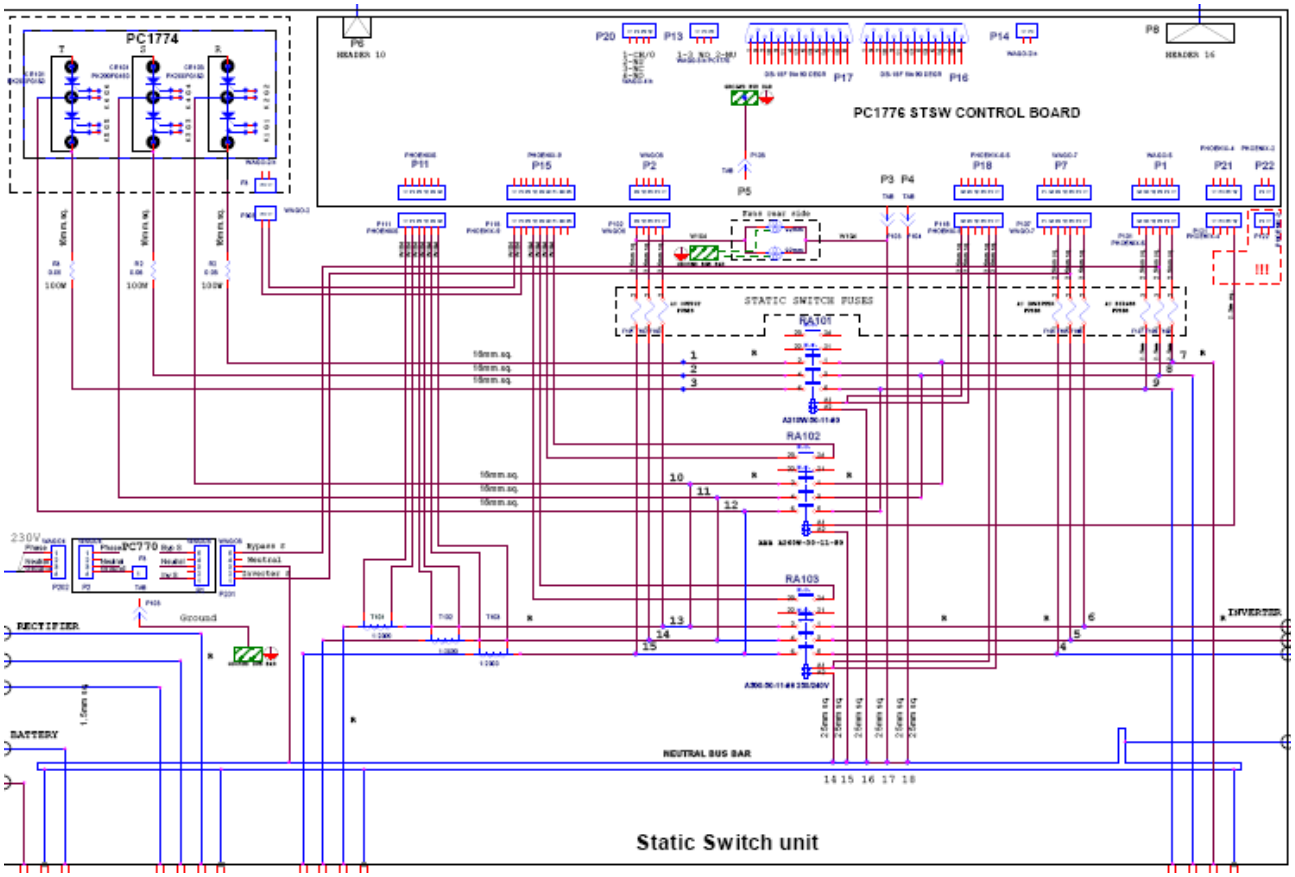

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Fig. 3
Power Module. PC1012 board

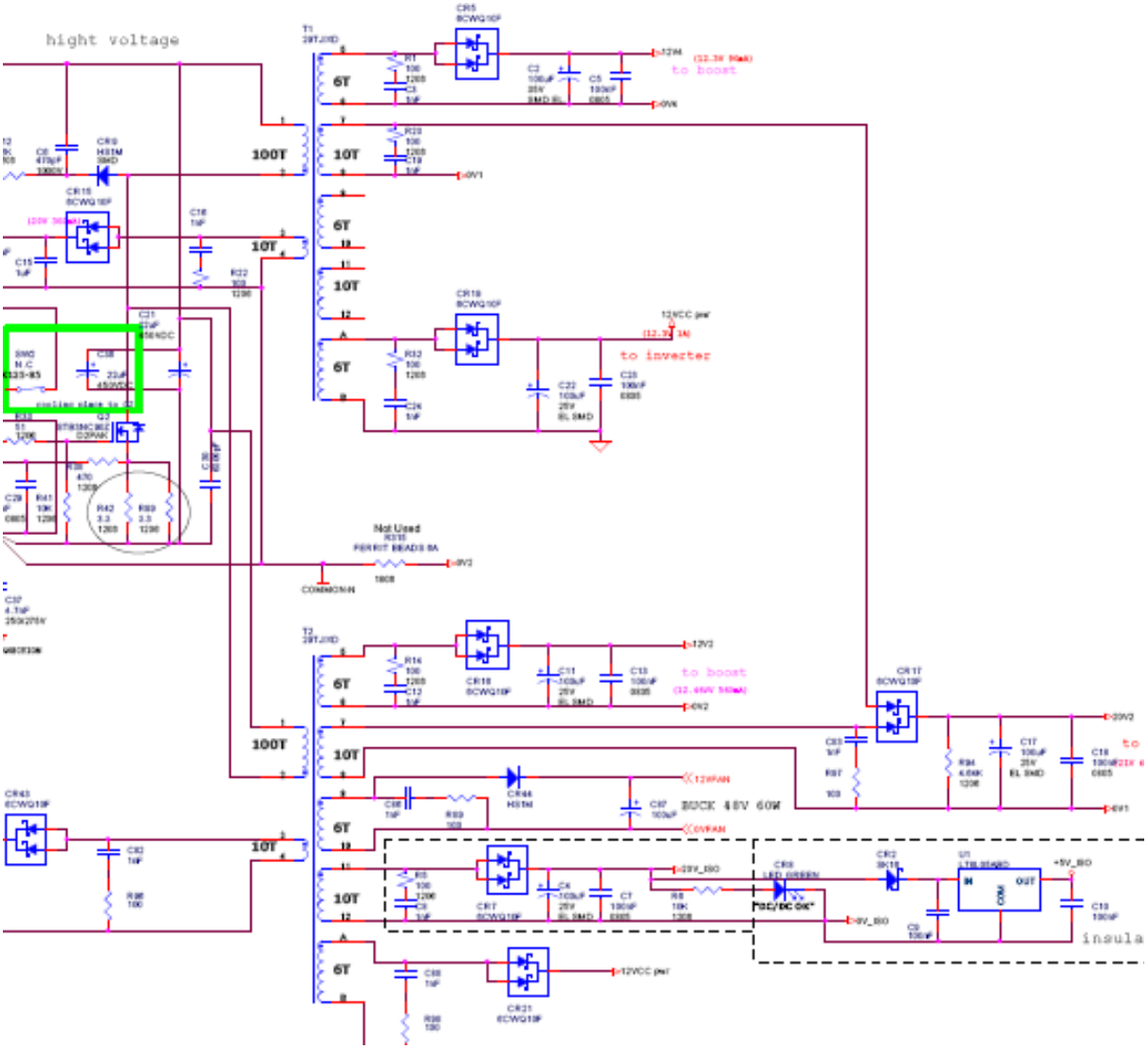

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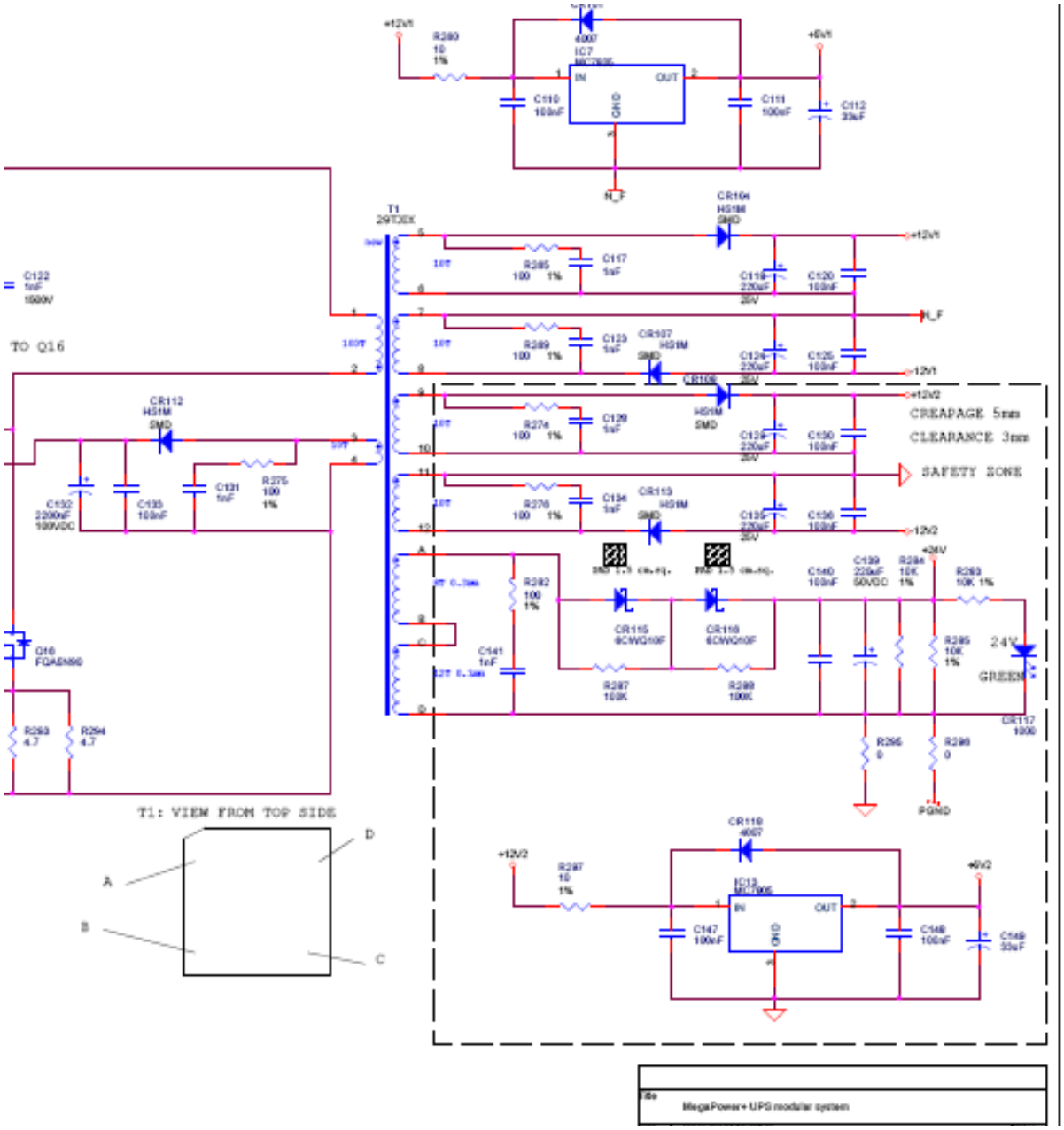
Fig. 4
Static Switch. PC 1776 board



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APPENDIX 3
EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES (EN 62040-1: 2008)

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IEC 62040_1A - ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict

ATTACHMENT TO TEST REPORT IEC 62040-1
EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES

Uninterruptible power systems (UPS) –

Part 1: General and safety requirements for UPS

Differences according to.....:	EN 62040-1:2008
Attachment Form No.....:	EU_GD_IEC62040_1A
Attachment Originator .....:	Nemko
Master Attachment.....:	Date (2010-06)

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EN 62040-1:2008 – CENELEC COMMON MODIFICATIONS

EN 62040-1, GROUP DIFFERENCES (CENELEC common modifications EN)			
Clause	Requirement + Test	Result - Remark	Verdict
Contents	Add the following annexes: Annex ZA (normative) Normative references to international publications with their corresponding European publications Annex ZB (normative) Special national conditions		P

IEC 62040_1A - ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict

EN 62040-1, GROUP DIFFERENCES (CENELEC common modifications EN)			
Clause	Requirement + Test	Result - Remark	Verdict
ZA	**NORMATIVE REFERENCES TO INTERNATIONAL PUBLICATIONS WITH THEIR CORRESPONDING EUROPEAN PUBLICATIONS** The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies. Note: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD Applies.		—

Publication	Year	Title	EN/HD	Year
IEC 60364-4-42	-[1)]	Electrical installations of buildings - Part 4-42: Protection for safety - Protection against thermal effects	-	-
IEC 60417	Data-base	Graphical symbols for use on equipment	-	-
IEC 60529	-[1)]	Degrees of protection provided by enclosures (IP Code)	EN 60529 + corr. May	1991[2)] 1993
IEC 60664	Series	Insulation coordination for equipment within low-voltage systems	EN 60664	Series
IEC/TR 60755	-[1)]	General requirements for residual current operated protective devices	-	-
IEC 60950-1 (mod)	2005	Information technology equipment - Safety - Part 1: General requirements	EN 60950-1	2006
IEC 61000-2-2	-[1)]	Electromagnetic compatibility (EMC) - Part 2-2: Environment - Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems	EN 61000-2-2	2002[2)]
IEC 61008-1 (mod)	-[1)]	Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCB's) - Part 1: General rules	EN 61008-1 + A11	2004[2)] 2007
IEC 61009-1 (mod)	-[1)]	Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBO's) - Part 1: General rules	EN 61009-1 + corr. July + A11	2004[2)] 2006 2008
IEC 62040-2	2005	Uninterruptible power systems (UPS) - Part 2: Electromagnetic compatibility (EMC) requirements	EN 62040-2 + corr. November	2006 2006
IEC 62040-3 (mod)	1999	Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements	EN 62040-3	2001

[1)] Undated reference.
[2)] Valid edition at date of issue.

IEC 62040_1A - ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict

ZB ANNEX (normative)

SPECIAL NATIONAL CONDITIONS (EN)

The FI, NO and SE - SNCs originate from IEC 60950-1 2nd Edition, which is the reference document (RD) for IEC 62040-1. The national requirements are included in IEC 62040-1 through the following statement in the scope of the standard:
"National requirements additional to those in IEC 60950-1 apply and are found as notes under relevant clauses of the RD."

The national requirements have not been specifically listed in the EN 62040-1:2008.

If demanded, CLC/TC 22X will be requested to take proper measures to complete EN 62040-1 with Annexes ZB containing the SNCs as presented below.

EN 62040-1:2008 supersedes EN 62040-1-1:2003. As a reference, see also SNCs for Finland, Norway and Sweden as included in the earlier EN 62040-1-1:2003

Clause	Requirement + Test	Result - Remark	Verdict
4.7.3	In **Finland**, **Norway** and **Sweden**, when safety relies upon connection to the safety earth (see 5.3), a pluggable equipment type A UPS shall have a marking on the equipment, stating that the UPS must be connected to an earthed mains socket-outlet. The marking text in the applicable countries shall be as follows: In **Finland**: "Laite on liitettävä suojakoskettimilla varustettuun pistorasiaan" In **Norway**: "Apparatet må tilkoples jordet stikkontakt" In **Sweden**: "Apparaten skall anslutas till jordat uttag"	Not pluggable equipment	N/A
4.7.11	In **Norway**, because of a widely used IT power system, equipment shall be designed or modified for connection to such a system and shall be marked by a label with the following wording in Norwegian: "Apparatet er egnet for tilkopling til et IT forsyningsnett"	Not tested for IT power system	N/A
9	In **Finland, Norway and Sweden** requirements of 6.1.2.1 and 6.1.2.2 in Annex ZB of EN 60950-1:2001 apply.	No TNV circuitry	N/A